



THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE-632115

B.Sc. CHEMISTRY

SYLLABUS

FROM THE ACADEMIC YEAR

2023 - 2024

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1.INTRODUCTION

B.Sc. Chemistry: Programme Outcome, Programme Specific Outcome and Course Outcome

Chemistry is the study of composition and transformation of matter. A science that is central to energy production, health care, new material development for electronics and other applied fields and environmental protection. Bachelor's degree in Chemistry is the culmination of in-depth knowledge of Inorganic, Organic and Physical chemistry and specialized courses such as Pharmaceutical Chemistry, spectroscopy, Nanoscience, Forensic Science, Cosmetics & Personal Grooming, Food chemistry, Dairy Chemistry and so on. Thus, this programme helps learners in building a solid foundation for higher studies in Chemistry. The hands on

experience the students gain in Practicals enable them to apply theory to solve problems in everyday life, think critically and innovatively. An aptitude for research is instilled through project work and industrial internship.

Students completing this programme will be able to present the concepts of Chemistry clearly and precisely. They can find solutions to pressing problems that mankind is facing today. They can interpret data and present their findings to both scientific community and laymen and have ability to work as a team and evolve to become an entrepreneur

Completion of this programme will also enable the learners to join teaching profession, conducting research in Industry and Government run research labs. A B.Sc chemistry student has the option to diversify to other branches such as Biochemistry, Biotechnology, Forensic Science etc... They have employability opportunities in public and private sector jobs in energy, pharmaceutical, Food, cosmetic industries etc...

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	B.Sc. Chemistry
Programme Code:	
Duration:	3 Years (UG)

Programme Outcomes:	<p>1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study</p> <p>2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.</p> <p>3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.</p> <p>4: Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.</p> <p>5: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.</p> <p>6: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation</p> <p>7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team</p> <p>PO8: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.</p> <p>PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.</p> <p>PO10 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.</p> <p>PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. PO 12 Multicultural competence: Possess knowledge of the values and beliefs of</p>
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	<p>multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.</p> <p>PO 13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.</p> <p>PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.</p> <p>PO 15: Lifelong learning: Ability to acquire knowledge and skills, including „learning how to learn“, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.</p>
<p>Programme Specific Outcomes:</p>	<p>On successful completion of Bachelor of Physics with Computer Applications programme, the student should be able to:</p> <p>PSO1: Disciplinary Knowledge: Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory.</p> <p>PSO2: Critical Thinking: Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively</p> <p>PSO3: Problem Solving: Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.</p> <p>PSO4: Analytical & Scientific Reasoning: Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.</p> <p>PSO5: Research related skills: Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.</p> <p>PSO6: Self-directed & Lifelong Learning: Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.</p>

PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	!!					
PO2		!!				
PO3			!!			
PO4				!!		
PO5					!!	
PO6						!!

2. Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising statistical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced statistical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Statistics based problem solving skills are included as mandatory components in the ‘Training for Competitive Examinations’ course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Statistical Quality Control course is included to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest DBMS and Computer software for Analytics.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	Foundation Course To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Statistics and simulating mathematical concepts to real world.	<ul style="list-style-type: none"> • Instil confidence among students • Create interest for the subject
I, II, III, IV	Skill Enhancement papers (Discipline centric / Generic / Entrepreneurial)	<ul style="list-style-type: none"> • Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects
		• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.
		<ul style="list-style-type: none"> • Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	<ul style="list-style-type: none"> • Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong statistical background

		<ul style="list-style-type: none"> Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of statistical models in the respective sectors
IV	DBMS and Programming skill, Biostatistics, Statistical Quality Control, Official Statistics, Operations Research	<ul style="list-style-type: none"> Exposure to industry moulds students into solution providers Generates Industry ready graduates Employment opportunities enhanced
II year Vacation activity	Internship / Industrial Training	<ul style="list-style-type: none"> Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V Semester	Project with Viva – voce	<ul style="list-style-type: none"> Self-learning is enhanced Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	<ul style="list-style-type: none"> Curriculum design accommodates all category of learners; ‘Statistics for Advanced Explain’ component will comprise of advanced topics in Statistics and allied fields, for those in the peer group / aspiring researchers; ‘Training for Competitive Examinations’ –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
Extra Credits: For Advanced Learners / Honors degree		<ul style="list-style-type: none"> To cater to the needs of peer learners / research aspirants

Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
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1.Template for Curriculum Design for UG Programme in Chemistry

Credit Distribution for UG Programme in Chemistry

B.Sc Chemistry First Year – Semester-I

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses [in Total]	13	16
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
		23	32

Semester-II

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	16
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
		23	32

Second Year – Semester-III

Part	List of Courses	Credit	No. of Hours
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	15
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	2	2
		24	32

Semester-IV

Part	List of Courses	Credit	No. of Hours
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	16
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
		23	32

**Third Year
Semester-V**

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Elective Based	22	26
Part-4	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	2
		26	30

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based & LAB	18	28
Part-4	Extension Activity	1	-
	Professional Competency Skill	2	2
		21	30

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	1	22
Part V	-	-	-	-	-	2	2
Total	23	23	22	25	26	21	140

***Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

B.Sc Chemistry Curriculum Design

First Year

Semester- I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language – Tamil	3	6
Part-II	English	3	6
Part-III	General Chemistry–I CC1	5	6
	Quantitative Inorganic estimation (titrimetry) and Inorganic Preparations CC2	5	5
	Mathematics (or) Botany /Zoology EC1	3	5
Part-IV	Skill Enhancement Course SEC-1: Food Chemistry	2	2
	Foundation Course FC	2	2
		23	32

Semester-II

Part		Credit	Hours per week (L/T/P)
Part-I	Language – Tamil	3	6
Part-II	English	3	6
Part-III	General Chemistry–II CC3	5	5
	Qualitative Organic Analysis and preparation of Organic Compounds CC4	5	5
	Mathematics (or) Botany /Zoology EC 2	3	6
Part-IV	Skill Enhancement Course SEC-2: Dairy Chemistry	2	2
	Skill Enhancement Course SEC-3 (Discipline Specific) Cosmetics and Personal care Products	2	2
		23	32

Second Year

Semester-III

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language – Tamil	3	6
Part-II	English	3	6
Part-III	General Chemistry–III CC5	5	5
	Qualitative Inorganic AnalysisCC6	5	5
	Physics EC 3	3	5
Part-IV	Skill Enhancement Course SEC-4: Entrepreneurial skills in Chemistry	1	1
	Skill Enhancement Course SEC-5: (Discipline Specific) Pesticide Chemistry	2	2
	EVS	2	2
		24	32

Semester-IV

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language – Tamil	3	6
Part-II	English	3	6
Part-III	General Chemistry–IV CC7	5	5
	Physical Chemistry Practical- I CC8	5	5
	Physics EC 4	3	6
Part-IV	Skill Enhancement Course SEC-6 : Instrumental methods of Chemical Analysis (Theory)	2	2
	Skill Enhancement Course SEC-7: (Discipline Specific) Forensic Science	2	2
		23	32

Third Year**Semester V**

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Organic Chemistry -I CC9	4	5
	Inorganic Chemistry - I CC10	4	4
	Physical Chemistry -I CC11	4	5
	Biochemistry EC5	3	4
	Industrial Chemistry EC 6	3	4
	Project with viva-voce CC12	4	4
Part IV	Value Education	2	2
	Internship / Industrial Visit / Field Visit(Carried out in II Year Summer vacation) (30 hours)	2	2
		26	30

Semester VI

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Organic Chemistry -II CC13	3	5
	Inorganic Chemistry - II CC14	3	5
	Physical Chemistry -II CC15	4	5
	Physical Chemistry Practical II CC16	2	3
	EC7 Fundamentals of Spectroscopy	3	5
	EC 8Nanoscience/Polymer science/ Pharmaceutical Chemistry (Elective based)	3	5
Part IV	Professional Competency Skill	2	2
Part V	Extension Activity	1	0
		21	30

Remarks: English Soft Skill Two Hours Will be handled by English Teachers (4+2 = 6 hours for English).

Title of the Course	GENERAL CHEMISTRY-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	UNIT I						
	Atomic structure and Periodic trends						
	History of atom (J.J.Thomson, Rutherford); Moseley’s Experiment and Atomic number, Atomic Spectra; Electronic Configuration of Atoms and ions- Hund’s rule, Pauli’s exclusion principle and Aufbau principle; Black-Body Radiation and Planck’s quantum theory - Bohr's model of atom; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength-Davisson and Germer experiment Heisenberg’s Uncertainty Principle;						
	Numerical problems involving the core concepts.						
Course Outline	Unit II						
	Introduction to Quantum mechanics						
	Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2 .						
	Modern Periodic Table						
Course Outline	Cause of periodicity ; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity.						
	Problems involving the core concepts						

	<p>UNIT-III: Structure and bonding - I</p> <p>Ionic bond</p> <p>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 polarisation – polarising power and polarizability; Fajans’ rules - effects of polarisation on properties of compounds; problems involving the core concepts.</p> <p>Covalent bond</p> <p>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</p> <p>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.</p> <hr/> <p>UNIT-IV: Structure and bonding - II</p> <p>VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, CO_3^{2-}, NO_3^-; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, C_2, O_2, O_2^+, O_2^-, O_2^{2-}, N_2, NO, HF, CO; 2 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-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA(Examples only); Effects of chemical force, melting and boiling points.</p> <hr/> <p>UNIT-V:</p> <p>Basic concepts in Organic Chemistry and Electronic effects</p> <p>Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrenes.</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 carbonium ions, carbanions and free</p>
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	<p>radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance.</p> <p>Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane</p> <p>Types of organic reactions- addition, substitution, elimination and rearrangements</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)</p>
Skills acquired from this course	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
Recommended Text	<ol style="list-style-type: none"> 1. Madan, R. D. and Sathya Prakash, <i>Modern Inorganic Chemistry</i>, 2nded.; S. Chand and Company: New Delhi, 2003. 2. Rao, C.N. R. <i>University General Chemistry</i>, Macmillan Publication: New Delhi, 2000. 3. Puri, B. R. and Sharma, L. R. <i>Principles of Physical Chemistry</i>, 38thed.; Vishal Publishing Company: Jalandhar, 2002. 4. Bruce, P. Y. and Prasad K. J. R. <i>Essential Organic Chemistry</i>, Pearson Education: New Delhi, 2008. 5. Dash UN, Dharmarha OP, Soni P.L. <i>Textbook of Physical Chemistry</i>, Sultan Chand & Sons: New Delhi, 2016
Reference Books	<ol style="list-style-type: none"> 1. Maron, S. H. and Prutton C. P. <i>Principles of Physical Chemistry</i>, 4thed.; The Macmillan Company: New York, 1972. 2. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4th ed.; ELBS William Heinemann: London, 1991. 3. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i>, 26thed.; Goel Publishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. <i>Physical Chemistry</i>, 10th ed.; Oxford University Press: New York, 2014. 5. Huheey, J. E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, 4th ed.; Addison, Wesley Publishing Company: India, 1993.

Website and e-learning source	1) https://onlinecourses.nptel.ac.in 2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm 3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html 4) https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding 5) https://www.chemtube3d.com/
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds. CO2: classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents. CO3: apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx , Δp electronegativity, percentage ionic character and bond order. CO4: evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects CO5: construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

GENERAL CHEMISTRY-I

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

1. Write down the electronic configuration of Zn.
2. Define electronegativity.
3. Define the term ionic bond.
4. What is the bond order of CO molecule.
5. What is meant by No bond resonance?
6. Benzoic acid reacts with methanol and hydrogen chloride to form methyl benzoate; but 2,6-dimethyl benzoic acid does not form the corresponding product under the same conditions. Explain with reason.
7. Define surface tension.
8. Define liquid crystals.
9. Normality.
10. Calculate the equivalent weight of calcium carbonate and potassium permanganate.

SECTION B – (5 × 5 = 25 marks)

Answer ALL questions

11. A) What are the periodic properties of elements? Explain any two properties in detail.
(Or)
B) What are the important characteristics of s,p,d,f block elements.
12. A) What is meant by electronegativity. Explain about Mulliken scale of electronegativity.
(Or)
B) What is meant by ionization potential. I) Electron affinity II) stability of orbitals.
13. A) Define Lattice energy. Discuss about Born-Haber cycle. (Or)
B) What are the salient features of VSEPR theory.
14. A) Compare VB and MO theory. (Or)

B) Draw and explain the MO diagram of H₂ and F₂.

15. A) Explain the structure and stability of carbocations, carbocations and free radical.

(Or)

B) what is meant by homolytic fission and heterolytic fission with examples.

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

16. Explain the following quantum numbers (a)Aufbau principle, (b) Pauli's exclusion principle, (c)Hund's rule.
17. Define atomic radii, ionic radii. What are all the factors effecting the atomic radii & ionic radii.
18. Discuss the general properties of ionic compounds & covalent compounds.
19. Discuss about VSEPR & MO theory.
20. Discuss about inductive effect, steric effect and hyperconjugation with example.

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 hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	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 safetyhandling glasswaresQuantitative estimationpreparation of inorganic compounds						
Course Outline	Unit I						
	Chemical Laboratory Safety in Academic Institutions						
	Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.						
	Common Apparatus Used in Quantitative Estimation (Volumetric)						
	Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.						
	Principle of Quantitative Estimation (Volumetric)						
	Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.						

	Unit II Quantitative Estimation(Volumetric) Preparation of standard solution, dilution from stock solution Permanganometry Estimation of sodium oxalate using standard ferrous ammonium sulphate
	Dichrometry Estimation of ferric alum using standard dichromate (external indicator) Estimation of ferric alum using standard dichromate (internal indicator) Iodometry Estimation of copper in copper sulphate using standard dichromate Argentimetry Estimation of chloride in barium chloride using standard sodium chloride/ Estimation of chloride in sodium chloride (Volhard's method)
	Unit III Complexometry Estimation of hardness of water using EDTA Estimations Estimation of iron in iron tablets Estimation of ascorbic acid. Preparation of Inorganic compounds- Potash alum Tetraammine copper (II) sulphate Hexamminecobalt (III) chloride Mohr's Salt (Any 5 experiments)
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.
Reference Books	1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; <i>Vogel's Textbook of Quantitative Chemical Analysis</i> , 6 th ed.; Pearson Education Ltd: New Delhi, 2000.
Website and e-learning source	Web References: 1) http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis 2) https://chemdictionary.org/titration-indicator/

Course Learning Outcomes (for Mapping with POs and PSOs)

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

CO1: explain the basic principles involved in titrimetric analysis and inorganic preparations.

CO2: compare the methodologies of different titrimetric analysis.

CO3: calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.

CO4: assess the yield of different inorganic preparations and identify the end point of various titrations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

SCHEME OF VALUATION
Quantitative Inorganic Estimation (titrimetry) and Inorganic
Preparations

Internal assessment: 25 Marks

External assessment: 75 marks

Total: 100 marks

Max. Marks: 75

Record: 15 Marks

Volumetric Analysis: 40 Marks

Preparation: 20 Marks (Quantity- 10 Marks; Quality- 10 marks)

Volumetric Analysis : 40 Marks (Maximum)

Error upto 2 % : 40 Marks

2 to 3 % : 30 Marks

3 to 4 % : 20 Marks

4 to 5 % : 10 Marks

> 5 % : 10 Marks

Arithmetic error : Deduct 1 mark

Wrong calculation : Deduct 20 % of marks scored

No calculation : Deduct 40 % of marks scored

Title of the Course	FOOD CHEMISTRY						
Paper No.	SEC –I						
Category	NME	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	This course aims at giving an overall view of the ★ 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 – tastemakers – MSG - vinegar.						
	UNIT-IV Beverages Beverages-softdrinks-soda-fruitjuices-alcoholicbeverages-examples. Carbonation-addictionto alcohol– diseases ofliver andsocial problems.						

	UNIT-V Edible Oils Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases - determination of iodine value, RM value, saponification values and their significance.
Recommended Text	1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. 2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co. Publishers, second edition, 2006. 3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. 4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022. 5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Padmini S Ghugre, New age international publishers, second edition, 2021.
Reference Books	1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4 th Edition, 2009. 2. M. Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979. 3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008. 4. Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009. 5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.
Website and	

e-learning source	
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter. CO 2: get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion CO 3: get an exposure on food additives, artificial sweeteners, Saccharin, Cyclamate and Aspartate in the food industries. CO 4: acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples. CO 5: study about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Food Chemistry

Model Question Paper

SECTION A – (10 × 2 = 20 marks)

Answer all the questions

1. Draw the structure of fructose.
2. Write any two advantages of artificial sweetners.
3. Mention any two nutritive value of soyabean.
4. Mention the nutritive value of egg.
5. Give the nature of any one malted beverage.
6. What are appetizers?
7. Write any two food preservatives.
8. What is food irradiation.
9. State any two flavoring agents.
10. Write any two food colors.

SECTION B – (5 × 5 = 25 marks)

Answer all the questions

11. A) List the toxic constituents present in pulses.

or

B) Explain the classification of cereals.

12. A) Give an account of fungi and algae as food.

or

B) Write the nutritive value of milk.

13. A) Write any five fruit-based beverages.

or

B) Write a note on alcoholic beverages with examples.

14. A) Explain the classification of food preservatives.

or

B) Describe about food spoilage.

15. A) Discuss the function of food additives.

or

B) What are the materials used for packing of foods?

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

16. Write a note on i) properties of sugar and, ii) medicinal values of cereals and pulses.
17. Explain enzymatic and non-enzymatic browning.
18. Explain i) alcoholic based and, ii) malted based beverages.
19. Describe low and high temperature method of food preservation.
20. Write a note on i) Restricted food colors and, ii) MSG.

Title of the Course	GENERAL CHEMISTRY-II						
Paper No.	Core III						
Category	Core	Year	I	Credits	5	Course Code	
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
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</p> <p>Acids, bases and Ionic equilibria Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators; Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation; Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product - determination and applications; numerical problems involving the core concepts.</p> <p>Unit-II</p> <p>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. Anomalous behaviour of Be.</p> <p>Chemistry of p- Block Elements (Group 13 & 14) preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates.</p>
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UNIT-III**Chemistry of p- Block Elements (Group 15-18)**

General characteristics of elements of Group 15; chemistry of $\text{H}_2\text{N}-\text{NH}_2$, NH_2OH , HN_3 and HNO_3 . Chemistry of PH_3 , PCl_3 , PCl_5 , POCl_3 , P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4).

General properties of elements of group 16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur SO_2 SO_3 H_2SO_4 and selenium SeO_2 - Oxy acids of sulphur (Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electronegativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF , HCl , HBr and HI), oxides and oxy acids (HClO_4). Inter-halogen compounds (ICl , ClF_3 , BrF_5 and IF_7), pseudo halogens [$(\text{CN})_2$ and $(\text{SCN})_2$] and basic nature of Iodine.

Noble gases: Position in the periodic table. Preparation, properties and structure of XeF_2 , XeF_4 , XeF_6 and XeOF_4 ; uses of noble gases - clathrate compounds.

	<p>UNIT-IV</p> <p>Hydrocarbon Chemistry-I Petroproducts: Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses</p> <p>Alkenes-Nomenclature, general methods of preparation – Mechanism of β-elimination reactions – E_1 and E_2 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;</p> <p>Alkadienes Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels– Alder reactions — polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene.</p> <p>Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene.</p> <p>Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations.</p>
Extended Professional Component (is a part of internal	<p>UNIT-V</p> <p>Hydrocarbon Chemistry - II Benzene: Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's $(4n+2)$ rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity.</p> <p>Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at β position – reduction, oxidation – uses.</p> <p>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.</p>

component only, Not to be included in the external examination question paper)	
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded, S.Chand and Company, New Delhi. 2. Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi. 3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi. 4. Tewari K S, Mehrotra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi. 5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar.
Reference Books	<ol style="list-style-type: none"> 1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, New York. 2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi. 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London. 4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India. 5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed., Goel Publishing House, Meerut. 6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8th ed., Goel Publishing House, Meerut.
Website and e-learning source	<p>https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/smbblack/chem1010/lecture_notes/4B.html</p> <p>http://www.auburn.edu/~deruija/pdareson.pdf https://swayam.gov.in/course/64 - atomic-structure-and-chemical-bonding</p> <p>MOOC components</p> <p>http://nptel.ac.in/courses/104101090/</p> <p>Lecture 1: Classification of elements and periodic properties</p> <p>http://nptel.ac.in/courses/104101090/</p>

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- CO1:** explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons
- CO2:** discuss the periodic properties of s and p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids
- CO3:** classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons
- CO4:** explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements
- CO5:** assess the application of hard and soft acids indicators, buffers, compounds of s and p-block elements and hydrocarbons

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

GENERAL CHEMISTRY-II

Model Question Paper

SECTION A – ($10 \times 2 = 20$ marks)

Answer ALL questions

1. Write a short note on the concept of Bronsted-Lowry theory.
2. Define a solubility product.
3. Mention the uses of KClO_3 .
4. Write any two alloys of Al.
5. Write down any four oxy-acids of sulphur.
6. What is meant by pseudo-halogens?
7. What is cracking?
8. What is geometric isomerism, given a suitable example?
9. Define Huckel's rule.
10. Mention any two uses of naphthalene.

SECTION B – ($5 \times 5 = 25$ marks)

Answer ALL questions

11. a) Discuss the theory of acid base indicators.

Or

- b) Derive the Hederson- Hasselbalch equation.

12. a) Discuss the anomalous behavior of Berilium.

Or

- b) Write notes on the comparison between carbon and silicon.

13. a) Discuss the chemical properties of P_2O_5 and PH_3 .

Or

- b) Discuss the inert halogen compounds of ICl , ClF_3 and IF_7 .

14. a) Discuss the Hofmann and Saytzeff rule with a suitable example.

Or

b) Explain the conformational analysis of cyclohexane.

15. a) Discuss the MO of benzene.

Or

b) Discuss the Haworth synthetic preparation method of Anthracene.

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

16. Discuss the mechanism of buffer action in acids and bases.

17. Discuss the preparation and structure of diborane and borazine.

18. Explain the preparation, properties, and structure of XeF_2 , XeF_4 , and XeOF_4 .

19. Write notes on Brayer's strain theory and mention its limitations.

20. Explain the following electrophilic reactions of anthracene:

- a) Nitration
- b) Sulphonation
- c) Friedel-Crafts acylation
- d) Halogenation
- e) Friedel-Crafts alkylation

Title of the Course	QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS						
Paper No.	Core IV						
Category	Core	Year	I	Credits	2	Course Code	
		Semester	II				

Instructional hours per week	Lecture	Tutorial	Lab Practice	Total
	-	-	3	3
Prerequisites	General Chemistry II			
Objectives of the course	This course aims at providing knowledge on <ul style="list-style-type: none"> laboratory safety handling glass wares analysis of organic compounds preparation 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"> monocarboxylic acid, dicarboxylic acid monohydric phenol, polyhydric phenol aldehyde, ketone, ester carbohydrate (reducing and non-reducing sugars) primary, secondary, tertiary amine monoamide, diamide, thioamide anilide, nitro compound Preparation of derivatives for functional groups 			

UNIT III**Preparation of Organic Compounds (Any 5)**

- i. Nitration - picric acid from Phenol
- ii. Halogenation - p-bromo acetanilide from acetanilide
- iii. Oxidation - benzoic acid from Benzaldehyde
- iv. Microwave assisted reactions in water:
- v. Methyl benzoate to Benzoic acid
- vi. Salicylic acid from Methyl Salicylate
- vii. Rearrangement - Benzil to Benzilic Acid
- viii. Hydrolysis of benzamide to Benzoic Acid

Separation and Purification Techniques (Not for Examination)

1. Purification of organic compounds by crystallization (from water / alcohol) and distillation
2. Determination of melting and boiling points of organic compounds.
3. **Steam distillation** - Extraction of essential oil from citrus fruits/eucalyptus leaves.
4. **Chromatography (any one) (Group experiment)**
 - (i) Separation of amino acids by Paper Chromatography
 - (ii) Thin Layer Chromatography - mixture of sugars / plant pigments / permanganate dichromate.
 - (iii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate.
5. **Electrophoresis** – 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. <i>Basic Principles of Practical Chemistry</i> , 2 nd ed.; Sultan Chand: New Delhi, 2012. 2. Manna, A.K. <i>Practical Organic Chemistry</i> , Books and Allied: India, 2018. 3. Gurtu, J. N; Kapoor, R. <i>Advanced Experimental Chemistry (Organic)</i> , Sultan Chand: New Delhi, 1987. 4. Furniss, B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. <i>Vogel's Textbook of Practical Organic Chemistry</i> , 5 th ed.; Pearson: India, 1989.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: observe the physical state, odour, colour and solubility of the given organic compound.

CO2: identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.

CO3: compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.

CO4: exhibit a solid derivative with respect to the identified functional group.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12

Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0
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Level of Correlation between PSO's and CO's

SCHEME OF VALUATION
QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF
ORGANIC COMPOUNDS

Internal assessment: 25 Marks

External assessment: 75 marks

Total: 100 marks

Max. Marks: 75

Record: 15 Marks

Preparation: 20 (quantity: 10 & quality: 10)

Organic Analysis: 40 Marks

Organic Analysis : 40 Marks

Aliphatic or Aromatic: 6 Marks

Saturated or unsaturated: 6 Marks

Tests for elements: 9 Marks

Preliminary Test: 7 Marks

Confirmation Tests: 12 Marks.

Title of the Course	DAIRY CHEMISTRY						
Paper No.	SEC- II						
Category	NME	Year	I	Credits	2	Course Code	
		Semester	II				
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">• chemistry of milk and milk products• processing of milk• preservation 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 methods of separation of cream - estimation of fat in cream. Butter - definition -composition - theory of churning – desi butter - salted butter, estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity - definition - prevention - antioxidants and synergists - natural and synthetic.						
	UNIT IV: Special Milk Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk -						
	condensed milk - definition, composition and nutritive value.						

	<p>UNIT V</p> <p>Fermented and other Milk Products</p> <p>Fermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - Bulgarious milk -acidophilous milk – Yoheer Indigeneous products- khoa and chhena definition - Ice cream -definition-percentage composition-types-ingredients-manufacture of ice-cream, stabilizers - emulsifiersandtheirrole-milkpowder-definition-needformakingmilkpowder- dryingprocess-types of drying.</p>
Recommended Text	<ol style="list-style-type: none"> 1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006. 2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974. 3. Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1 st edition, 2008. 4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition,2013. 5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.
Reference Books	<ol style="list-style-type: none"> 1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005. 2. F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006. 3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980. 4. P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016. 5. Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A. OMahony, Springer, Second edition, 2015.
Website and e-learning source	
<p>Course Learning Outcomes (for Mapping with POs and PSOs)</p> <p>On completion of the course the students should be able to</p> <p>CO 1: understand about general composition of milk – constituents and its physical properties.</p> <p>CO 2: acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.</p> <p>CO 3: learn about Cream and Butter their composition and how to estimate fat in cream and Ghee</p> <p>CO 4: explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.</p> <p>CO 5: have an idea about how to make milk powder and its drying process - types of drying process</p>	

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

DAIRY CHEMISTRY

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

1. Define Milk.
10. Give the general Constituents of milk?
11. What is meant by Pasteurization?
12. How will you destruct the micro-organisms in milk?
13. Write the composition of Butter.
14. Define Rancidity.
15. Differentiate between flavoured milk and toned milk.
16. What is the nutritive value of condensed milk?
17. Define and give an example for cultured cream.
18. What is need for making milk powder?

SECTION B – (5 × 5 = 25 marks)

Answer ALL questions

11. a) What are the factors affecting the composition of milk? Explain it?

Or

- b) Discuss the adulterants of the milk and how will you detect it.

12. a) Discuss the physio-chemical changes takes place in milk

Or

- b) Write note on Vacuum Pasteurization.

13. a) Discuss the common adulterants added to ghee and how will you detect it?

Or

- b) How will you estimate the fat in cream?

14. a) Discuss the merits of standardized milk.

Or

b) Discuss the composition and nutritive value of condensed milk.

15. a) Discuss the composition and types of Ice-creams.

Or

b) Discuss the drying process of milk powder? What are the types of drying?

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

19. Discuss the physical properties of milk in detail?

20. Define pasteurization. Explain the various type of pasteurization with examples.

21. Define butter. Write the composition of butter and explain the theory involved in butter.

22. Discuss the composition and nutritive value of

1. Vitaminised milk.
2. Incitation milk.
3. Humanized milk.

21. Explain What is meant by fermented milk products? Discuss the various conditions of fermentation milk and cultured milk?

Title of the Course	COSMETICS AND PERSONAL GROOMING						
Paper No.	SEC-III (Discipline Specific)						
Category	SEC	Year	I	Credits	2	Course Code	
		Semester	I/ II				
Instructional	Lecture	Tutorial	Lab Practice		Total		
hours per week	2	-	-		2		
Prerequisites	Higher secondary Chemistry						
Objectives of the course	<p>This course aims at familiarizing the students with</p> <ul style="list-style-type: none">• formulations of various types of cosmetics and their significance• hair, skin and dental care• makeup preparations and personal grooming						
Course Outline	Uni I Skin care Nutrition of the skin, skin care and cleansing of the skin; face powder – ingredients; creams and lotions – cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels – formulation and advantages; astringent and skin tonics – key ingredients, skin lightness, depilatories.						
	Unit II Hair care Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients Dental care Tooth pastes – ingredients – mouth wash						
	Unit III Make up Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge						
	Unit IV Perfumes Classification - Natural – plant origin – parts of the plant used, chief constituents; animal origin – amber gries from whale, civetone from civet cat, musk from musk deer; synthetic – classification emphasizing characteristics – esters – alcohols – aldehydes – ketones						

	Unit V Beauty treatments Facials - types – advantages – disadvantages; face masks – types; bleach - types – advantages– disadvantages; shaping the brows; eyelash tinting; perming – types; hair colouring and dyeing ; permanent waving – hair straightening; wax – types – waxing; pedicure, manicure - advantages – disadvantages
Recommended Text	1. Thankamma Jacob, (1997) Foods, drugs and cosmetics – A consumer guide, Macmillan publication, London.
Reference Books	1. Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7 th ed., Chemical Publishers, London. 2. George Howard, (1987) Principles and practice of perfumes and cosmetics, Stanley Theron, Chettnam
Website and e-learning source	1. http://www.khake.com/page75.html 2. Net.foxsm/list/284
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to <ul style="list-style-type: none"> • CO1: know about the composition of various cosmetic products • CO2 understand chemical aspects and applications of hair care and dental care and skin care products. • CO3 understand chemical aspects and applications of perfumes and skin care products. • CO4 to understand the methods of beauty treatments their advantages and disadvantage • CO5 understand the hazards of cosmetic products. 	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

COSMETICS AND PERSONAL GROOMING

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

Answer all the questions

1. what is meant by skin care ?
2. what is meant by gel.
3. give the types of shampoo's
4. what are the ingredients of mouth wash.
5. explain the meaning foundation
6. what are the main ingredients of eye shadows?
7. explain the origin of perfume?
8. explain the different types of animal origin?
9. what are the different types of bleach?
10. what are the different types of wax process?

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

11. a) explain in detail about the ingredients of creams and lotions
(or)
b) explain the nutrition of the skin and cleaning of the skin.

12. a) discuss the ingredients and types of powder.

(or)

b) discuss the ingredients and types of tooth paste.

13. a) explain the types and ingredients of eyelines.

(or)

b) explain the types and ingredients of base-formation.

14. a) explain the classifications of plant origin and parts of the plants used.

(or)

b) explain detail the constituents animal of origin?

15. a) discuss the types advantages and disadvantages of facials.

(or)

b) write notes on hair straightening.

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

16. a) explain the ingredients of shaving and sunscreen. (4)

b) explain the formulation and advantages of astringent and skin tonics. (6)

17. a) discuss the types and ingredients of cream and conditioner (6)

b) discuss the types of ingredients of mouth wash (4)

18. discuss the types of ingredients of

a) lipstick

b) mascara

c) concealers

19. discuss the classification and characteristics of synthetic perfumes

20. discuss the types , advantages and disadvantages of (2.5 x 4= 10)

a) pedicure

b) manicure

c) hair coloring

d) dying

Title of the Course	GENERAL CHEMISTRY -III						
Paper No.	Core V						
Category	Core	Year	II	Credits	5	Course Code	
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	General Chemistry – I and II						
Objectives of the course	<p>This course aims to provide a comprehensive knowledge on</p> <ul style="list-style-type: none">the physical properties of gases, liquids, solids and X-ray diffraction of solids.fundamentals of nuclear chemistry and nuclear waste management.applications of nuclear energybasic chemistry of halo-organic compounds, phenol and other aromatic alcohols.preparation and properties of phenols and alcohols.						
Course Outline	UNIT I Gaseous state Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell –Boltzmann distribution of speed of molecules- average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases. Real gases: Deviations from ideal gas behaviour, (Andrew’s and Amagat’s plots); compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases-van der Waal’s equation; Virial equation; Boyle temperature; Numerical problems based on equations of states for real gases, isotherms of real gases – critical phenomena – isotherms of CO ₂ -continuity of state–Van der waal’s equation and the critical state; law of corresponding states-liquefaction of gases; numerical problems involving the core concepts.						
	Unit-II Liquid and Solid State Properties of Liquids- Surface tension, viscosity and their applications. Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Crystals –size and shape; laws of crystallography; symmetry elements – plane,						

	<p>centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg’s equation</p> <p>Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO₂; comparison of structure and properties of diamond and graphite;.numerical problems involving core concepts</p> <p>Defects in solids - stoichiometric and nonstoichiometric defects.</p> <p>Liquid crystals – classification and applications.</p>
	<p>UNIT-III Nuclear Chemistry</p> <p>Natural radioactivity - alpha, beta and gamma rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series.</p> <p>Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out)</p> <p>Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.</p> <p>.</p>
	<p>UNIT-IV</p> <p>Halogen derivatives Aliphatic halogen derivatives Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent.</p> <p>Di, Tri & Tetra Halogen derivatives: Nomenclature, classification, preparation, properties and applications of CH₂Cl₂, CHCl₃, CCl₄.</p> <p>Aromatic halogen compounds Nomenclature, preparation, properties and uses Mechanism of nucleophilic aromatic substitution – benzyne intermediate.</p> <p>Aryl alkyl halides Nomenclature, benzyl chloride – preparation – preparation properties and uses</p> <p>Alcohols: Nomenclature, classification, preparation, properties, use; conversions – ascent and descent of series; test for hydroxyl groups. Oxidation of diols by periodic acid and lead tetraacetate.</p>

	<p>UNIT-V Phenols Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions – Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction.</p> <p>Resorcinol, quinol, picric acid – preparation, properties and uses.</p> <p>Aromatic alcohols Nomenclature, benzyl alcohol – methods of preparation – hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation – substitution on the benzene nucleus, uses. Thiols: Nomenclature, structure, preparation and properties.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. B.R. Puri, L.R. Sharma, M.S. Pathania; <i>Principles of Physical Chemistry</i>, 46th edition, Vishal Publishing, 2020. 2. B.R. Puri, L.R. Sharma and K.C. Kalia, <i>Principles of Inorganic Chemistry</i>, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009. 3. 4. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand & amp; Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i>, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., third edition, 1994.

Reference Books	1. T. W. Graham Solomons, <i>Organic Chemistry</i> , John Wiley & Sons, fifth edition, 1992. 2. A. Carey Francis, <i>Organic Chemistry</i> , Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, 2009. 3. I. L. Finar, <i>Organic Chemistry</i> , Wesley Longman Ltd, England, sixth edition, 1996.
	4. P. L. Soni, and H. M. Chawla - <i>Text Book of Organic Chemistry</i> , New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007. 5. J.D. Lee, <i>Concise Inorganic Chemistry</i> , Blackwell Science, fifth edition, 2005.
Website and e-learning source	MOOC components https://nptel.ac.in/courses/104104101 Solid state chemistry https://nptel.ac.in/courses/103106071 Nuclear industries and safety https://nptel.ac.in/courses/104106119s Introduction to organic chemistry
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: explain the kinetic properties of gases by using mathematical concepts. CO2: describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations. CO3: investigate the radioactivity, nuclear energy and its production, also the nuclear waste management. CO4: write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols. CO5: investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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GENERAL CHEMISTRY-III

Model Question Paper

SECTION A – ($10 \times 2 = 20$ marks)

Answer ALL questions

1. Define Boyle's temperature.
2. What is RMS velocity.
3. Define liquid crystals.
4. State laws of crystallography.
5. Define Nuclear binding energy.
6. What are radioactive series.
7. What is nucleophilic substitution reaction.
8. Give the reason why benzene will not undergoes nucleophilic substitution reaction.
9. Write the reaction of nitration of phenol.
10. What is catalysis hydrogenation.

SECTION B – ($5 \times 5 = 25$ marks)

Answer ALL questions

11. A) Discuss the Maxwell distribution of molecular velocities

(or)

B) Derive the kinetic gas equation.

12. A) What is mean by seven crystal system. Explain in detail.

(or)

B) What are liquid crystals? How are they classified.

13. A) Difference between Nuclear fission and Nuclear fusion

(or)

B) What are the types of nuclear reactions? Give example.

14. A) Explain the mechanism of SN1 reaction.

(or)

B) Describe the Aromatic Nuclear Substitution reaction with example

15. A) Briefly explain the acidic character of phenol

(or)

B) Write the notes on I) Remer Tiemann reaction II) Houben Hoesh reaction.

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

16. A) What is mean by viscosity and surface tension. What is the effect of temperature on it.

B) Write notes on liquid crystals.

17. Write the notes on Bravis Space lattice.

18. Write an account on application of Nuclear Chemistry.

19. Write preparation, properties and uses of Benzyl chloride.

20. Briefly explain the following reactions

I) Kolbe's reaction.

II) Gatterman reaction.

III) Claisen rearrangement.

IV) Cannizaro reaction.

Title of the Course	ENTREPRENEURIAL SKILLS IN CHEMISTRY						
Paper No.	SEC IV						
Category	Skill Enhancement Course	Year Semester	II III	Credits	1	Course Code	
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	1		1		
Total marks	50(10 internal + 40 external)						
Prerequisites	General Chemistry						
Objectives of the course	The course aims at providing training to <ul style="list-style-type: none">• develop entrepreneur skills in students• to provide hands on experience to prepare and develop products•develop start ups						
Course Outline	UNIT -I Food Chemistry Food adulteration-contamination of food items with clay stones, water andtoxicchemicals -Common adulterants. Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect),food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast,MSG,vinegar. Dyes Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing						
	UNIT II Hands on Experience (Students can choose any four) Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques. Preparation of Jam, squash and Jelly, Gulkand, cottage cheese. Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powde rand disinfectants in small scale. Extraction of oils from spices and flowers. Testing of water samples using testing kit. Dyeing – cotton fabrics with natural and synthetic dyes Printing – tie and dye, batik.						

Skills acquired from this course	Entrepreneurial skills.
Recommended Text	1. George S & Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai. 2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.
Reference Books	Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice), Elsevier, e Book ISBN 9087128004289, 1 st Edition, 2015
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: identify adulterated food items by doing simple chemical tests. CO 2: prepare cleaning products and become entrepreneurs CO 3: educate others about adulteration and motivate them to become entrepreneurs.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
Weightage	6	6	6	6	6
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Title of the Course	PESTICIDE CHEMISTRY (10 internal + 40 external)						
Paper No.	Skill Enhancement Course V (Discipline specific)						
Category	Skill Enhancement Course	Year Semester	II III	Credits	2	Course Code	
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Total marks	50(10 internal + 40 external)						
Prerequisites	Fundamentals in chemistry						
Objectives of the course	<p>This course aims to providing the students</p> <ul style="list-style-type: none">• knowledge about the various types of pesticides and their toxicity.• to understand the accumulation of pesticides in in the form of residues and its analysis.• knowledge on choice of alternate and eco-friendly pesticides.						
Course Outline	<p>Unit I</p> <p>Introduction: History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties.</p> <p>Toxicity of pesticides: Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides.</p> <p>Insecticides: Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity.</p> <p>Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.</p> <p>Unit II</p> <p>Pesticides residues: Introduction- application of agrochemicals, dissemination pathways of pesticides, causes of pesticide residues, remedies. Pesticides residues in atmosphere- entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water - entry into water systems, action and effect in aquatic environment. Pesticides residues in soil. entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility, decomposition and degradation by climatic factors and microorganism.</p> <p>Pesticide Residues effect and analysis: Effects of pesticides residue on human life, birds and animals- routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues- sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.</p>						

	Unit III Biopesticides: Pheromones, attractants, repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012. 2. Matolcsy G, Nádas M, Andriska V. Pesticide chemistry. Elsevier; 1989. 3. J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press, 1985. 4. R. Cremllyn: Pesticides, John Wiley.
Reference Books	1. Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors P Ltd; 1st Ed. (2010). 2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods of pesticide residues analysis. CRC press; 2016. 3. Ellerbrock R.H., Pesticide Residues: Significance, Management and Analysis, 2005
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: teach about the pesticides and their toxicity with respect to structure and category. CO 2: explain the preparation and property of pesticides CO 3: investigate the pesticide residues, prevention and care CO 4: demonstrate the extraction and analytical methods of pesticide residues CO 5: make awareness to the public on bio-pesticides	

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3

CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

Title of the Course	QUALITATIVE INORGANIC ANALYSIS						
Paper No.	Core VI						
Category	Core	Year	II	Credits	2	Course Code	
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	1	-	3		4		
Prerequisites	General chemistry						
Objectives of the course	To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.						
Course Outline	Semi - Micro Qualitative Analysis 1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, iodide, nitrate 2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite. 3. Elimination of interfering acid radicals and Identifying the group of basic radicals 4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc,manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium 5. Analysis of a mixture - I to VI containing two cations and two anions (of which one is interfering type)						
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.						
Recommended Text	Reference Books: V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.						
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences						
Course Learning Outcomes (for Mapping with POs and PSOs)							

On successful completion of the course the students should be able to **CO 1:**

acquire knowledge on the systematic analysis of Mixture of salts.

CO 2: identify the cations and anions in the unknown substance.

CO 3: identify the cations and anions in the soil and water and to test the quality of water.

CO4: assess the role of common ion effect and solubility product

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

SCHEME OF VALUATION INORGANIC QUALITATIVE ANALYSIS

Internal assessment: 25 Marks

External assessment: 75 Marks

Total: 100 marks

Record: 15 Marks

Analysis: 40 Marks.

Each radical with procedure: 20 Marks

(Spotting for each radical - 5 Marks; Fixing the group - 5 Marks)

Title of the Course	GENERAL CHEMISTRY-IV						
Paper No.	Core VII						
Category	Core	Year	II	Credits	4	Course Code	
		Semester	I V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	-	-		4		
Prerequisites	General Chemistry III						
Objectives of the course	<p>This course aims to provide a comprehensive knowledge on</p> <ul style="list-style-type: none">• thermodynamic concepts on chemical processes and applied aspects.• thermo chemical calculations• transition elements with reference to periodic properties and group study of transition metals.• the organic chemistry of ethers, aldehydes and ketones• the organic chemistry of carboxylic acids						
Course Outline	<p>UNIT I</p> <p>Thermodynamics I</p> <p>Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson effect- inversion temperature Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels</p> <p>Zeroth law of thermodynamics-Absolute Temperature scale.</p>						

Unit II

Thermodynamics II

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

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell

relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application. Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.

UNIT III

General Characteristics of d-block elements

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

UNIT IV

Ethers, Thio ethers and Epoxides

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

Aldehydes and Ketones

Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein - Ponnendorf Verley reduction, reduction with LiAlH_4 and NaBH_4 .

Addition reactions of unsaturated carbonyl compounds: Michael addition.

UNIT V

Carboxylic Acids: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.

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

	<p>degradation and Curtius rearrangement.</p> <p>Active methylene compounds: Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate</p> <p>Halogen substituted acids – nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids</p> <p>Hydroxy acids – nomenclature; preparation from halo, amino, aldehydic and ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on α, β and γ hydroxy acids.</p>
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Extended Professional	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved
Component (is a part of internal component only, Not to be included in the external examination question paper)	(To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. B.R. Puri and L.R. Sharma, <i>Principles of Physical Chemistry</i>, Shoban Lal Nagin Chand and Co., thirty three edition, 1992. 2. K. L. Kapoor, <i>A Textbook of Physical chemistry</i>, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009. 3. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand & Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i>, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., third edition, 1994.
Reference Books	<ol style="list-style-type: none"> 1. Maron, S. H. and Prutton C. P. <i>Principles of Physical Chemistry</i>, 4th ed.; The Macmillan Company: Newyork, 1972. 2. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4th ed.; ELBS William Heinemann: London, 1991. 3. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i>, 26th ed.; Goel Publishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. <i>Physical Chemistry</i>, 10th ed.; Oxford University Press: New York, 2014. 5. Huheey, J. E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, 4th ed; Addison Wesley Publishing Company: India, 1993.

Website and e-learning source	MOOC components https://nptel.ac.in/courses/112102255 Thermodynamics https://nptel.ac.in/courses/104101136 Advanced transition metal chemistry
Course Learning Outcomes (for Mapping with POs and PSOs)	
On completion of the course the students should be able to	
CO1: explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.	
CO2: discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.	
CO3: investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.	
CO4: discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.	
CO5: discuss the chemistry and named reactions related to carboxylic acids and their derivatives; discuss chemistry of active methylene compounds, halogen substituted acids and hydroxyl acids.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

GENERAL CHEMISTRY-IV

Model Question Paper

SECTION A – ($10 \times 2 = 20$ marks)

Answer ALL questions

1. What is mean by exothermic and endothermic reactions.
2. State and explain first law of thermodynamics.
3. Write the Maxwell's equation.
4. Write Nernst heat theorem.
5. Write the electronic configuration of Co, Ni.
6. Write the uses of Uranium hexafluoride.
7. Write the reaction of Perkin reaction.
8. What is the structures of thio ethers and how it is prepared?
9. How are carboxylic acids are classified.
10. Explain the action of heat on Glutaric acid

SECTION B – ($5 \times 5 = 25$ marks)

Answer ALL questions

11. A) Derive the relationship between C_p and C_v .
(or)
B) What are intensive and extensive properties.
12. A) State and explain all the statements of second law of thermodynamics.
(or)

B) Derive Gibbs Helmholtz equation.

13. A) Write down the various possible oxidation state of chromium group elements.

(or)

B) write preparation, property and use of Ammonium Molybdate

14. A) Discuss the mechanism of Knoevenagel reaction.

(or)

B) Write a note on reaction of Michael addition reaction.

15. A) Discuss Curtius rearrangement

(or)

B) Explain and detail about HVZ reaction.

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

16. Derive the kirchoffs equation. Mention it's significance.

17. Write a short note on a) Carnot cycle

b) Entropy of mixing of ideal gas

18. Comparative study of Ti group elements.

19. Discuss the mechanism of a) Wolf – kishner reduction b) MP verley reduction

20. Write down the synthetic application of Ethylacetoacetate..

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Title of the Course	PHYSICAL CHEMISTRY PRACTICAL – I						
Paper No.	Core VIII						
Category	Core	Year	II	Credits	2	Course Code	
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	3		3		
Prerequisites	General Chemistry						
Objectives of the course	The course aims at providing an understanding of <ul style="list-style-type: none">the laboratory experiments in order to understand the concepts of physical changes in chemistrythe rates of chemical reactionscolligative properties and adsorption isotherm						
Course Outline	UNIT-I Chemical kinetics 1. Determination of rate constant of acid catalysed hydrolysis of an ester						

	(methyl acetate). 2. Determination of order of reaction between iodide and persulphate (initial rate method). 3. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar Thermochemistry 4. Determination of heat of neutralisation of a strong acid by a strong base. 5. Determination of heat of hydration of copper sulphate.
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	<p>UNIT II</p> <p>Electrochemistry – Conductance measurements</p> <p>6. Determination of cell constant</p> <p>7. Determination of molar conductance of strong electrolyte</p> <p>8. Determination of dissociation constant of acetic acid</p> <p>Colorimetry</p> <p>9. Determination of concentration of copper sulphate solution</p> <p>UNIT III</p> <p>Colligative property</p> <p>10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent</p> <p>Adsorption</p> <p>11. Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal</p>
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	<p>1. Sindhu, P.S. <i>Practicals in Physical Chemistry</i>, Macmillan India : New Delhi, 2005.</p> <p>2. Khosla, B. D. Garg, V. C.; Gulati, A.; <i>Senior Practical Physical Chemistry</i>, R. Chand : New Delhi, 2011.</p> <p>3. Gupta, Renu, <i>Practical Physical Chemistry</i>, 1st Ed.; New Age International: New Delhi, 2017.</p>
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences
<p>Course Learning Outcomes (for Mapping with POs and PSOs)</p> <p>On completion of the course the students should be able to</p> <p>CO1: describe the principles and methodology for the practical work</p> <p>CO2: explain the procedure, data and methodology for the practical work.</p> <p>CO3: apply the principles of electrochemistry, kinetics for carrying out the practical work.</p> <p>CO4: demonstrate laboratory skills for safe handling of the equipment and chemicals</p>	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

SCHEME OF VALUATION

Internal assessment: 25 Marks

External assessment: 75 Marks

Total: 100 Marks

Record: 15 Marks

Experiment: 45 Marks

Manipulation, Tabulation and Calculation: 15 Marks

1) Kinetics

Graph : 10 Marks

Below a factor of 10 : 35

By a factor of 10 : 25

More than a factor of 10 : 15

2) Molecular weight

Error upto 10 %: 45

20 %: 35
30 %: 25
> 30 %: 15

3) Effect of electrolyte on CST

Graph: 10
Error upto 10 %: 35
20 %: 25
30 %: 15
> 30: 10

4) ConductanceEquivalent conductance: 25 marks

Error upto 10 % : 25
Upto 15 % : 15
>15 % : 10

Cell constant : 20 marks

Error upto 10 % : 20
Upto 15 % : 15
>15 % : 10

5) Conductometric titration

Graph: 10
Upto 2 % : 35
2.1 to 3 % : 30
3.1 to 4 % : 25
4.1 to 5 % : 20
> 5% : 15

Title of the Course	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS						
Paper No.	SEC VI (Discipline specific)						
Category	Skill Enhancement Course	Year	II	Credits	2	Course Code	
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	General Chemistry						
Objectives of the course	The course aims at providing an overall view of the <ul style="list-style-type: none">• operation and troubleshooting of chemical instruments• fundamentals of analytical techniques and its application in the characterization of compounds• theory of chromatographic separation and						

	<ul style="list-style-type: none"> • theory of thermo / electro analytical techniques • stoichiometry and the related concentration terms
Course Outline	UNIT-I Qualitative and Quantitative Aspects of Analysis Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q- test, F-test, T-test. The Least Square Method for Deriving Calibration plots. Principles of gravimetric analysis-characteristics of precipitating agents-choice of precipitants-conditions of precipitation-specific and selective precipitants-DMG, cupferron, salicylaldehyde, ethylene diamine-use of sequestering agent-co-precipitation, Post precipitation difference-reduction of errors-peptisation-precipitation from homogeneous solution-calculation in gravimetric methods-use of gravimetric factor.

	<p>UNIT II Atomic Absorption Spectroscopy: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.</p> <p>UNIT III UV-Visible and IR Spectroscopy Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.</p> <p>UV-Visible Spectrometry: Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.</p> <p>UNIT IV Thermal and Electro-analytical Methods of Analysis TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate DSC- Principle, Instrumentation and applications.</p> <p>Electroanalytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry - principle.</p> <p>UNIT V Separation and purification techniques</p>
	<p>Classification, principle, Factors affecting - Solvent Extraction – Liquid - Liquid Extraction, Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms and R_f value.</p>

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman. 2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007 3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017). 4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993. 5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th edn., Prentice Hall of India Private Ltd., New Delhi, 1993
Reference Books	<ol style="list-style-type: none"> 1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edn., Saunders college publishing, Philadelphia, 1998. 2. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011. 3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004. 4. Mikes, O. & Chalmers, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London 5. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000
Website and e-learning sources	<ol style="list-style-type: none"> 1. http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf 2. http://eric.ed.gov/?id=EJ386287 3. http://www.sjsu.edu/faculty/watkins/diamag.htm 4. http://www.britannica.com/EBchecked/topic/108875/separation-and-purification 5. http://www.chemistry.co.nz/stoichiometry.htm

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry

CO2: explain theory, instrumentation and application of UV visible and Infrared spectroscopy.

CO3: able to discuss instrumentation, theory and applications of thermal and electrochemical techniques

CO4: explain the use of chromatographic techniques in the separation and identification of mixtures

CO5: explain preparation of solutions, stoichiometric calculations

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Title of the Course	FORENSIC SCIENCE						
Paper No.	SEC-VII (Discipline Specific)						
Category	Skill Enhance ment Course	Year Semester	II IV	Credits	2	Course Code	
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	General Chemistry						
Objectives of the course	This course aims at giving an overall view of <ul style="list-style-type: none">• crime detection through analytical instruments• forgery and its detection• medical aspects involved						
Course Outline	UNIT I Poisons Poisons - types and classification - diagnosis of poisons in the living and the dead -clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.						

	<p>Unit-II Crime Detection Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns.</p>
	<p>UNIT-III Forgery and Counterfeiting Documents - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays -comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using AAS to detect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.</p>
	<p>UNIT-IV Tracks and Traces Tracks and traces - small tracks and police dogs - foot prints - costing of</p>
	<p>foot prints -residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.</p>
	<p>UNIT-V Medical Aspects Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.</p>

Recommended Text	<ol style="list-style-type: none"> 1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011. 2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press, Taylor & Francis Group, 2019. 3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basic principles of Forensic chemistry, Humana Press, first edition, 2012. 4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad. 5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.
Reference Books	<ol style="list-style-type: none"> 1. Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition, 2003 2. Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014. 3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015. 4. Max M. Houck & Jay A. Segal, (2006) Fundamentals of Forensic Science, Elsevier Academic press. 5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) Henry Lee's Crime Scene Book Elsevier Academic press.
Website and e-learning source	<ol style="list-style-type: none"> 1. http://www.library.ucsb.edu/ist/03-spring/internet.html 2. http://www.wonderhowto.com/topic/forensic-science/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: learn about the Poisons - types and classification of poisons in the living and the dead organisms and also get information about Postmortem.

CO 2: get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices and other security measures for VVIP - composition of bullets and detecting powder burns

CO 3: detect the forgery documents, different types of forged signatures

CO4: have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies

CO 5: get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
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CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Title of the Course	ORGANIC CHEMISTRY - I						
Paper No.	Core IX						
Category	Core	Year	III	Credits	4	Course Code	
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	General Chemistry I,II, III and IV						
Objectives of the course	<p>This course aims to provide an understanding of</p> <ul style="list-style-type: none">• stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane• preparation and properties of aromatic and aliphatic nitro compounds and amines• preparation of different dyes, food colour and additives• preparation and properties of five membered heterocycles like pyrrole, furan and thiophene• preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.						

Course Outline	<p>UNIT I Stereochemistry</p> <p>Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations.</p> <p>Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centres, racemisation- methods of racemisation; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.</p> <p>Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.</p> <hr/> <p>UNIT II Chemistry of Nitrogen Compounds – I</p> <p>Nitroalkanes Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism.</p> <p>Aromatic nitro compounds Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT.</p>
	<p>Amines: Aliphatic amines Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement.</p> <p>Physical properties, reactions – alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.</p>

	<p>UNIT III Chemistry of Nitrogen Compounds – II</p> <p>Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann’s method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation.</p> <p>Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds</p> <p>Diazomethane, Benzene diazonium chloride - preparations and synthetic applications.</p> <p>Dyes Theory of colour and constitution; classification based on structure and application; preparation –Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green. Industry oriented content</p> <p>Dyes Industry, Food colour and additives</p> <p>UNIT IV Heterocyclic compounds Nomenclature and classification. General characteristics - aromatic character and reactivity. Five-membered heterocyclic compounds</p> <p>Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.</p> <p>Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction.</p> <p>Thiophene synthesis - from acetylene; reactions –reduction; oxidation;</p>
	electrophilic substitution reactions.

	<p>UNIT V</p> <p>Six-membered heterocyclic compounds</p> <p>Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses Condensed ring systems</p> <p>Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction</p> <p>Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<p>1.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.</p> <p>2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.</p> <p>3.ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition, 2012.</p> <p>4.P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.</p> <p>5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.</p>
Reference Books	<p>1.R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.</p> <p>2.T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition, 2012.</p>

	3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition, 2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.
Website and e-learning sources	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http://swayam.gov.in 4. Virtual Textbook of Organic Chemistry
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane. CO2: explain preparation and properties of aromatic and aliphatic nitro compounds and amines CO3: explain colour and constitution of dyes and food additives CO4: discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene CO5: discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15

Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0
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Level of Correlation between PSO's and CO's

ORGANIC CHEMISTRY-I

Model Question Paper

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

1. What are enantiomers? Give an example
2. Draw most stable conformer of ethane.
3. What is TNT? Draw the structure of it.
4. Write Mannich reaction.
5. Write Schmidt reaction.
6. Mention the name of any two food colours.

7. How will you prepare Pyrrole from succinimide?
8. Give Diels Alder reaction of furan.
9. Write Chichibabin reaction.
10. Write the oxidation reaction of quinoline using KMnO_4 .

SECTION B – ($5 \times 5 = 25$ marks)

Answer ALL questions

11. (a) Write the methods of racemization.
Or
(b) Explain the optical activity of allenes with suitable examples.
12. (a) Write the preparation and properties of nitroalkanes.
Or
(b) Explain Hofmanns' degradation reaction and Gabriel's phthalimide synthesis.
13. (a) Distinguish primary, secondary and tertiary amines.
Or
(b) Write the classification of dyes based on applications.
14. (a) Discuss the acidic and basic characters of pyrrole.
Or
(b) Give Electrophilic substitution reactions of furan.
15. (a) How will you prepare Isoquinoline by the Bischler – Napieralski reaction.
Or
(b) Write the preparation of Quinoline by Skraup synthesis

SECTION C – ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. Explain the conformational analysis of n-butane.
17. Discuss the preparation and properties of aromatic nitro compounds.
18. Write the preparation and synthetic applications of Diazomethane.

19. Explain the preparation and properties of thiophene.
20. Discuss the preparation, electrophilic and nucleophilic substitution reactions of pyridine.

Title of the Course	INORGANIC CHEMISTRY -I						
Paper No.	Core X						
Category	Core	Year	III	Credits	4	Course Code	
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	-	-		4		
Prerequisites	General Chemistry I , II, III and IV						
Objectives of the course	<p>The course aims to provide knowledge on</p> <ul style="list-style-type: none">• nomenclature, isomerism and theory of coordination compounds, and chelate complexes• crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect• preparation and properties of metal carbonyls• Lanthanoids and actinoids• preparation and properties of inorganic polymers						

Course Outline	<p>UNIT I Co-ordination Chemistry - I</p> <p>IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds.</p> <p>Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory – geometry of coordination compounds with co-ordination number 4 &6.</p> <p>Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis– application of DMG and oxine in gravimetric analysis –estimation of hardness of water using EDTA, metal ion indicators.</p> <p>Role of metal chelates in living systems – haemoglobin and chlorophyll</p>
	<p>Unit II Co-ordination Chemistry - II</p> <p>Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ - Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants- factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea). Comparison of VBT and CFT.</p>
	<p>UNIT III Organometallic compounds</p> <p>Metal Carbonyls Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls.</p> <p>Ferrocene-Methods of preparation, physical and chemical properties</p>

	<p>UNIT IV Inner transition elements (Lanthanoids and Actinoids)</p> <p>General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction- Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.</p>
	<p>UNIT V Inorganic polymers</p> <p>General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and properties of silicones (polydimethylsiloxane and polymethylhydrosiloxane) phosphorous based polymer (polyphosphazines and polyphosphonitrilic chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – industrial applications of inorganic polymers.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th Edition, Milestone Publishers & Distributors, Delhi. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi
	<ol style="list-style-type: none"> 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd. 5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.
Reference Books	<ol style="list-style-type: none"> 1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed ., S.Chand and Company, New Delhi.

	2. Gopalan R, (2009) <u>Inorganic Chemistry for Undergraduates</u> , 1st Edition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) <u>Inorganic Chemistry</u> , 1st Edition, Pearson, Chennai 4. Alan G. Sharp (1992), <u>Inorganic Chemistry</u> , 3 rd Edition, Addison- Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, <u>Inorganic Chemistry</u> , Oxford University Press, sixth edition, 2014.
Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http://swayam.gov.in
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: explain isomerism, Werner's Theory and stability of chelate complexes CO2: discuss crystal field theory, magnetic properties and spectral properties of complexes. CO3: explain preparation and properties of metal carbonyls CO4: give a comparative account of the characteristics of lanthanoids and actinoids CO5: explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15

Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0
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Level of Correlation between PSO's and CO's

INORGANIC CHEMISTRY-I

Model Question Paper

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

1. What is EAN rule? Give two examples in which this rule is not obeyed
2. Name the following according to IUPAC rules (i) $[\text{Co}(\text{NCS})(\text{NH}_3)_5]\text{Cl}_3$ (ii) $[\text{Co}(\text{en})_2\text{Br}(\text{ONO})]^+$
3. How does spin orbit coupling affect the paramagnetism of the complexes?

4. Which of the complex ions $[\text{FeF}_6]^{3-}$ and $[\text{Fe}(\text{CN})_6]^{3-}$ is paramagnetic and why?
5. In metallic carbonyls the M-C bond is shorter than calculated single bond length - Explain
6. Explain the structure of $\text{Ni}(\text{CO})_4$ and its nature.
7. Why are lanthanons called inner transition elements
8. Actinides have greater tendency to complex formation than lanthanides – Explain
9. Why silicones are called Inorganic polymer?
10. Give the preparation and properties of polydimethylsiloxane

SECTION B – (5 × 5 = 25 marks)

Answer ALL questions

11. a) Discuss the chelation with respect to stability of complexes

Or

- b) Suggest the possible isomeric structures for dichlorobis(ethylene diamine)rhodium (III) ion.

12. a) Discuss in detail the splitting of d-orbitals in the case of tetrahedral complexes

Or

- b) Write short notes on Jahn-Teller distortion.

13. a) How are carbonyls prepared? Discuss the structure of $\text{Fe}(\text{CO})_5$.

Or

- b) How are mononuclear carbonyls are distinguished from polynuclear carbonyls?

14. a) Explain why lanthanide ions show a very sharp absorption bands in their electronic spectra.

Or

- b) Describe the extraction of thorium from monazite and mention some of its properties and uses.

15. a) What is polyphosphazene? How it is prepared? Give its properties.

Or

- b) Mention the industrial applications of Inorganic polymers

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

16. Explain the role of Haemoglobin and chlorophyll in living systems.
17. What do you understand by the terms Thermodynamic and kinetic stability of a complex? On what factors do they depend? How does VB theory account for the kinetic stability of the complexes.
18. Explain the synthesis and properties of Ferrocene.
19. What is lanthanide contraction? What effects does it have on the chemistry of later elements?
20. Mention the preparation, properties and Isoelectronic nature of borazine.

Title of the Course	PHYSICAL CHEMISTRY -I						
Paper No.	Core XI						
Category	Core	Year	III	Credits	4	Course Code	
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	General Chemistry I,II,III and IV						

Objectives of the course	<p>The course aims at providing an overall view of</p> <ul style="list-style-type: none"> • Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties • chemical kinetics and different types of chemical reactions • adsorption, homogeneous and heterogeneous catalysis • colloids and macromolecules • photochemistry, fluorescence and phosphorescence
Course Outline	<p>UNIT I Thermodynamics - III</p> <p>Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.</p> <p>Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs- Duhem-Margules equation.</p>
	<p>UNIT II Chemical Kinetics</p> <p>Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration) – Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry.</p> <p>Effect of temperature on reaction rate – temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.</p> <p>Complex reactions – reversible and parallel reactions (no derivation and only examples) kinetics of consecutive reactions – steady state approximation.</p>

	<p>UNIT III</p> <p>Adsorption – Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalysed reaction –Michaelis- Menten and Briggs- Haldene equation – Lineweaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations)</p> <p>– Catalysis – general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis. Heterogenous catalysis</p>
	<p>UNIT IV</p> <p>Colloids and Surface Chemistry</p> <p>Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols), Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols- Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis,</p> <p>Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids</p> <p>Macromolecules: Molecular weight of Macromolecules-Number average molecular weight- average molecular weight, Determination of Molecular weight of molecules</p>

	<p>UNIT V Photochemistry</p> <p>Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of $\text{H}_2\text{-Cl}_2$, $\text{H}_2\text{-Br}_2$ and $\text{H}_2\text{-I}_2$ reactions, comparison between thermal and photochemical reactions.</p> <p>Fluorescence – applications including fluorimetry – sensitised fluorescence, phosphorescence – applications - chemiluminescence and photosensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.
Reference Books	<ol style="list-style-type: none"> 1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013. 2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan

	India Ltd, third edition, 2009. 5. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalandhar, forty first, edition, 2001
Website and e-learning source	1. https://nptel.ac.in 2. https://swayam.gov.in 3. www.epgpathshala.nic.in
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellingham's CO2: apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation. CO3: compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogeneous and heterogeneous catalysis. CO4: demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules. CO5: utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

PHYSICAL CHEMISTRY-I

Model Question Paper

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

1. What are partial Molar properties?
2. Give a criteria for a spontaneity of a reaction.
3. List out the factors influencing rate of a reaction.
4. Compare molecularity and order of a reaction.
5. Give an example for auto catalysis.
6. Differentiate between physical and chemical adsorption.
7. What are colloids?
8. What is an electrical double layer?
9. Define quantum efficiency.
10. State photochemical laws.

SECTION B – ($5 \times 5 = 25$ marks)

Answer ALL questions

11. a) Derive Gibb's Helmholtz equation.

Or

- b) Write a Short note on Ellingham Diagram.

12. a) Compare collision theory and ARRT.

Or

- b) Derive the rate constant of second order reaction.

13. a) Discuss about Langmuir adsorption.

Or

- b) Discuss acid-base catalysis.

14. a) Write about preparation methods of Sols.

Or

- b) Write short note on electrophoresis.

15. a) Write the difference between phosphorescence and fluorescence. Discuss the MO of benzene.

Or

b) Discuss the chemistry of Vitamin A as a precursor.

SECTION C – ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. Describe how chemical potential varies with respect to T and P. Also derive Gibb's-Duhem-Margules equation.
17. Discuss the methods of determining order of a reaction.
18. Derive the kinetics of an enzyme catalyzed reaction.
19. Explain the methods of determination of molecular weight of a macromolecule.
20. Derive the rate equation of photochemical reaction between hydrogen-Chlorine

Title of the Course	INDUSTRIAL CHEMISTRY						
Paper No.	EC VI						
Category	Elective	Year	III	Credits	3	Course Code	
		Semester	V				
Instructional hours	Lecture	Tutorial	Lab Practice		Total		

per week	4	-	-	4
Prerequisites	General Chemistry I,II, III and IV			
Objectives of the course	<p>This course is designed to provide knowledge on</p> <ul style="list-style-type: none"> • classifications and characteristics of fuels • preparation of cosmetics • manufacture of sugar, paper, cement and leather and food processing • applications of abrasives, lubricants and other industrial products • intellectual property rights 			
Course Outline	<p>UNIT I Survey of Indian Industries and mineral resources in India</p> <p>Fuels: Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal- proximate analysis and ultimate analysis; calorific value-determination, carbonisation of coal.</p> <p>Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number.</p> <p>Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas - preparations - uses.</p> <p>Natural gas: LPG-composition, advantages, application; gobar gas-production, composition, advantages, application. Propellants – rocket fuels (basic idea)</p> <p>UNIT II Cosmetics</p> <p>Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations.</p> <p>Dental care: tooth pastes – ingredients.</p> <p>Hair care: shampoos-types, ingredients; conditioners-types, ingredients. Perfumes: natural-plant origin-parts of the plant used, chief constituents;</p>			

	<p>animal origin-amber gries, civetone and musk; synthetic-classification-esters-amylsalicylate alcohols-citronellol; terpeneols-geraniol and nerol; ketones-muskone, coumarin; aldehydes-vanilin.</p> <p>Soaps and Detergents</p> <p>Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap – ingredients.</p> <p>Detergents-definition, properties-cleansing action; soapless detergents-anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents.</p>
	<p>UNIT III Sugar Industry</p> <p>Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar.</p> <p>Food Preservation and processing</p> <p>Food spoilage – causes; Food preservation - methods – high temperature, low temperature, drying, radiation; Food additives – preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius.</p>
	<p>UNIT IV Abrasives</p> <p>Definition, characteristics, types-natural and synthetic; natural abrasives – diamond, corundum, emery, garnet, quartz – composition, uses; synthetic abrasives – carborundum, aluminium carbide, boron carbide, boron nitride, synthetic graphite – composition and uses.</p> <p>Leather Industry</p> <p>Structure and composition of skin, hide; Manufacture of leather – pre-tanning process – curing, liming, beating, pickling; methods of tanning-vegetable, chrome – one bath, two bath process; finishing.</p> <p>Paper Industry</p> <p>Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.</p>
	<p>UNIT V Lubricants Definition, classification-liquid, semi-solid, solid and synthetic; properties-viscosity index, flash point, cloud point, pour point, aniline point and drop point; greases-properties, types; cutting fluids,</p>

	<p>selection of lubricants.</p> <p>Cement Industry</p> <p>Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete.</p> <p>Intellectual Property Rights</p> <p>Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>
Skills acquired from this course	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
Recommended Text	<ol style="list-style-type: none"> 1. Sharma, B.K. <i>Industrial Chemistry</i>, 9th ed.; Goel Publishing House: Meerut, 1998. 2. Wilkinson, J.B.E. Moore, R.J. <i>Harry's Cosmeticology</i>, 7th ed.; Chemical Publishers : New York, 1982. 3. Alex V. Ramani, <i>Food Chemistry</i>, MJP publishers: Chennai, 2009. 4. Jayashree Ghosh, <i>Applied Chemistry</i>, S. Chand : New Delhi, 2006. 5. Srilakshmi, B. <i>Food Science</i>, 4th ed.; New Age International Publication, 2005.
Reference Books	<ol style="list-style-type: none"> 1. Jain, P.C.; Jain, M. <i>Engineering Chemistry</i>, 16th ed.; Dhanapet Rai: Delhi, 1992 2. George Howard, <i>Principles and Practice of Perfumes and Cosmetics</i>, Stanley Theron, Cheltenham: UK, 1987. 3. Thankamma Jacob, <i>Foods, Drugs and Cosmetics - A Consumer Guide</i>, Macmillan : London, 1997. 4. ShankuntalaManay, N.; Shadaksharaswamy, M. <i>Food Facts and Principles</i>, 3rd ed.; New Age Publication, 2008.

	5. Neeraj Pandey, Khushdeep Dharni, <i>Intellectual Property Rights</i> , PHI Learning, 2014.
Website and learning source	1. http://www.sciencecases.org/irradiation/irradiation_notes.asp 2. http://discovery.kcpc.usyd.edu.au/9.5.5/ 3. https://www.wipo.int/about-ip/en/ 4. www.nptel.ac.in 5. http://swayam.gov.in
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: summarize the properties of fuels which include petroleum, water gas, natural gas and propellents CO2: evaluate cosmetic products, soaps, detergents. CO3: explain manufacture of sugar, food spoilages and food additives CO4: explain properties of abrasives, manufacture of leather and paper CO5: explain properties and manufacture of lubricants and cement, and intellectual property rights	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

INDUSTRIAL CHEMISTRY

Model Question Paper

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

1. Define octane value of gasoline.
2. Write the composition of producer gas.
3. Difference between soap and detergents.
4. What are the ingredients for conditioners.
5. Write the composition of sugarcane.
6. What is sweetening agent? Give some examples.
7. What is Rag pulp?
8. Name some natural abrasives.
9. What is flash add fire point.
10. What is White port land cement?

SECTION B – (5 × 5 = 25 marks)

Answer ALL questions

11. A. Give an account of gobar gas and compare the properties of gobar gas with LPG

(or)

B. How is proximate analysis determined? What are its importance.

12. A. Explain the manufacturing of soap.

(or)

B. discuss the classification of esters in hair care.

13. A. Write notes on I) Sugarcane II) Sugar beat

(or)

B. Explain the sulphonation process with neat diagram

14. A. Name the hardest artificially prepared abrasive. What is the hardness on Mohr's scale?

Or

B. Express the various steps involved in mechanical process of manufacture of pulp.

15. A. Write briefly on the additive used in lubricants and their functions.

Or

B. Explain setting and hardening of cement. Write the raw materials used for cement.

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

16. Write with the neat diagram, the manufacture of synthetic gasoline.
17. Explain the manufacturing of leather.
18. Explain the various steps involved in the manufacture of cane sugar.
19. What are the different types of paper pulp? How are they produced.
20. With the neat sketch, the manufacture of Portland cement.

Title of the Course	BIOCHEMISTRY						
Paper No.	EC V						
Category	Elective	Year	III	Credits	4	Course Code	
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	Organic Chemistry - I						
Objectives of the	The course aims at providing knowledge on						

course	<ul style="list-style-type: none"> relationship between biochemistry and medicine, composition of blood structure and properties of amino acids, peptides, enzyme, vitamins and proteins biological functions of proteins, enzymes, vitamins and hormones biochemistry of nucleic acids and lipids metabolism of lipids
Course Outline	<p>UNIT I Logic of Living Organisms Relationship of Biochemistry and Medicine Blood - Composition of Blood, Blood Coagulation – Mechanism. Hemophilia and Sickle Cell Anaemia Maintenance of pH of Blood – Bicarbonate Buffer, Acidosis, Alkalosis.</p> <p>UNIT II Peptides and Proteins Amino acids – nomenclature, classification – essential and Non-essential; Synthesis - Gabriel Phthalimide, Strecker; properties – zwitter ion and isoelectric point, electrophoresis and reactions.</p> <p>Peptides – peptide bond – nomenclature – synthesis of simple peptides – solution and solid phase. Determination of structure of peptides, N-terminal analysis – Sanger's & Edmann method; C terminal analysis - Enzymic method.</p> <p>Proteins – classification based on composition, functions and structure; properties and reactions – colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins – primary, secondary, tertiary and quaternary. Metabolism of Amino acids – general aspects of metabolism (a brief outline); urea cycle.</p>

	UNIT III Enzymes and Vitamins Nomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model. Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin.
	UNIT IV Amino acids Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions;

	RNA –types– structure - functions; biosynthesis of proteins Hormones Adrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).
	UNIT V Lipids Occurrence, biological significance of fats, classification of lipids. Simple lipids – Oils and fats, chemical composition, properties, reactions – hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats – saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats. Compound lipids – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance. Cholesterol – occurrence, structure, test, physiological activity.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	<ol style="list-style-type: none"> 1. Bahl, B. S.; Bhal, A. <i>Advanced Organic Chemistry</i>, 3rd ed.; S. Chand: New Delhi, 2003. 2. Jain, M.K.; Sharma, S.C. <i>Modern Organic Chemistry</i>, Vishal Publications: New Delhi, 2017. 3. Shanmugam, A. <i>Fundamentals of Biochemistry for Medical Students</i>, 6th ed.; Published by the author, 1999. 4. Veerakumari, L. <i>Biochemistry</i>, 1st ed.; MJP Publications: Chennai, 2004. 5. Jain, J. L.; <i>Fundamentals of Biochemistry</i>, 2nd ed.; S.Chand: New Delhi, 1983.
Reference Books	<ol style="list-style-type: none"> 1. Conn, E. E.; Stumpf, P. K. <i>Outline of Biochemistry</i>, 5th ed.; Wiley Eastern: New Delhi, 2002. 2. West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. <i>Text Book of Biochemistry</i>, 4th ed.; Macmillan: New York, 1970. 3. Lehninger, A. L. <i>Principles of Biochemistry</i>, 2nd ed.; CBS Publisher: Delhi, 1993. 4. Rastogi, S. C. <i>Biochemistry</i>, 2nd ed.; Tata McGraw-Hill: New Delhi, 2003. 5. Chatterjea, M. N.; Shinde, R. <i>Textbook of Medical Biochemistry</i>, 5th ed.; Jaypee Brothers: New Delhi, 2002.
Website and e-learning source	<ol style="list-style-type: none"> 1) http://library.med.utah.edu/NetBiochem/nucacids.html 2) http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html 3) https://swayam.gov.in/courses/4384-biochemistry Biochemistry 4) https://onlinecourses.nptel.ac.in/noc19_cy07/preview Experimental Biochemistry
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: explain molecular logic of living organisms, composition of blood and blood coagulation CO2: explain synthesis and properties of amino acids, determination of structure of peptides and proteins CO3: explain factors influencing enzyme activity and vitamins as coenzymes CO4: explain RNA and DNA structure and functions CO5: explain biological significance of simple and compound lipids	

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

BIOCHEMISTRY**Model Question Paper****SECTION A – (10 × 2 = 20 marks)****Answer ALL questions**

1. What is Hemophilia?
2. Write the symptoms of Acidosis.
3. What are essential amino acids? Give an example.
4. Define denaturation.
5. What are coenzymes?
6. Write any two functions of TPP.
7. What are nucleotides?
8. Give any two functions of Adrenalin.
9. What is iodine number?
10. What is R.M. value?

SECTION B – (5 × 5 = 25 marks)**Answer ALL questions**

11. (a) Discuss the mechanism of blood coagulation.
Or
(b) Write a note on Sickle Cell Anaemia.
12. (a) How will you prepare amino acids by Gabriel Phthalimide method?
Or
(b) How will you determine N-terminals of peptides by Sanger's and Edmann's methods?
13. (a) Explain the lock and key mechanism.
Or
(b) Explain the functions of folic acid and biotin.

14. (a) Write the differences between DNA and RNA.

Or

- (b) Write notes on biosynthesis of proteins.

15. (a) Write the classification of lipids.

Or

- (b) Discuss about the biological functions of lipids.

SECTION C – (3 × 10 = 30 marks)

Answer any THREE questions

16. Discuss about the composition of Blood in detail.
17. Explain the primary and secondary structures of proteins.
18. Write the classification of enzymes and discuss the factors influencing the enzyme activity.
19. Explain the structure of DNA in detail.
20. Write the structure of cholesterol. Discuss the physiological activity of it.

Title of the Course	ORGANIC CHEMISTRY - II						
Paper No.	Core XIII						
Category	Core	Year	III	Credits	3	Course Code	
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	1	4	-		5		
Prerequisites	Organic Chemistry – I						
Objectives of the course	This course aims at providing knowledge on <ul style="list-style-type: none">• classification, isolation and discussing the properties of alkaloids and terpenes• preparation and properties of saccharides• biomolecules• different molecular rearrangement• preparation and properties of organometallic compounds						
Course Outline	UNIT I Alkaloids Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine. Terpenes: Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.						
	UNIT II Carbohydrates Definition and Classification of Carbohydrates with examples.Relative configuration of sugars. Determination of configuration (Fischer’s Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples. Monosaccharides – configuration – D and L hexoses – aldohexoses and ketohexoses. Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses. Interconversions of sugar series – ascending, descending, aldose to ketose and ketose to aldose. Disaccharides – sucrose, lactose, maltose - preparation, properties and uses (no structural elucidation). Polysaccharides – Source, constituents and biological importance of homopolysaccharides- starch and cellulose, heteropolysaccharides – hyaluronic acid, heparin.						
	UNIT III Molecular rearrangements: Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasién, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement						

	<p>UNIT IV Special reagents in organic synthesis AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP, NBS/NCS, NMP, PCC, TBHP, TEMPO Organometallic compounds in Organic Synthesis Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler – Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt</p>
	<p>UNIT V Green Chemistry: Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media – green solvents, green reagents and catalysts; tools used like microwave and ultra-sound in chemical synthesis.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>
Skills acquired from this course	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
Recommended Text	<ol style="list-style-type: none"> 1. M.K.Jain, S. C.Sharma, Modern Organic Chemistry, Vishal Publishing, 4th reprint,2009. 2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan IndiaLtd., 3rd edition,2009 3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition,2012. 4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 29th edition, 2007. 5. C Bandyopadhyay; An Insight into Green Chemistry; Published on 2020

Reference Books	<ol style="list-style-type: none"> 1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, 6th edition, 2012. 2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, 11th edition, 2012. 3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 7th edition, 2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, 6th edition, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5th Edition, 2010.
Website and e-learning source	<ol style="list-style-type: none"> 1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http://swayam.gov.in 4. Virtual Textbook of Organic Chemistry 5. https://vlab.amrita.edu/
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: explain isolation and properties of alkaloids and terpenes CO2: explain preparation and reactions of mono and disaccharides CO3: classify biomolecules and natural products based on their structure, properties, reactions and uses. CO4: explain molecular rearrangements like benzidine, Hoffmann etc., CO5: preparation and properties of organolithium compounds	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

ORGANIC CHEMISTRY-II

Model Question Paper

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

1. What are alkaloids? Give an example.
2. Write isoprene rule.
3. What are epimers?
4. What are carbohydrates?
5. Define anionotropic rearrangement.
6. What is Curtius rearrangement?
7. What is Grignard reagent?
8. What is Zeiss's Salt? Give the structure of it.
9. Mention any two green solvents.
10. Give any two principles of green chemistry.

SECTION B – (5 × 5 = 25 marks)

Answer ALL questions

11. (a) Explain Hofmann Exhaustive Methylation with suitable example.
Or
(b) Elucidate the structure of menthol.
12. (a) How will you convert glucose into fructose?
Or
(b) Discuss the properties of sucrose.

13. (a) Write the mechanism of Claisen rearrangement.

Or

- (b) What is Hofmann rearrangement? Write the mechanism of it.

14. (a) Account on the structure and properties of Zeiss's salt.

Or

- (b) Give an Account on DIBAL and 9BBN.

15. (a) Explain about microwave assisted synthesis with one example.

Or

- (b) Explain about ultra-sound assisted synthesis with one example

SECTION C – ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. Elucidate the structure of piperine.
17. Elucidate open chain and ring structures of glucose.
18. Discuss the mechanism of Beckmann and Pinacol-pinacolone rearrangements.
19. Explain the role of green chemistry in chemical synthesis.
20. Explain the preparation, properties and applications of organo lithium compounds.

Title of the Course	INORGANIC CHEMISTRY –II						
Paper No.	Core XIV						
Category	Core	Year	III	Credits	3	Course Code	
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4		-		4		
Prerequisites	Inorganic Chemistry – I						
Objectives of the course	<p>The course aims to provide knowledge on</p> <ul style="list-style-type: none">• tracer elements and their role in the biological system.• iron transport and storage• metallo enzymes, oxygen transport.• silicates and their applications• industrial applications of refractories, alloys, paints and pigments						
Course Outline	UNIT I Bioinorganic Chemistry Essential and trace elements: Role of Na ⁺ , K ⁺ , Mg ²⁺ , Ca ²⁺ , Fe ³⁺ , Cu ²⁺ and Zn ²⁺ in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg.						
	UNIT II Metal ion transport and storage Iron – storage, transport - Transferrin and Ferretin; Iron-porphyrins – myoglobin, haemoglobin – oxygen transport – Bohr effect; Sodium/potassium pump, calcium pump; transport and storage - copper and zinc.						
	UNIT III Metallo enzymes Isomerase and synthetases, structure of cyanocobalamin (Vitamin B12), nature of Co-C bond; Metalloenzymes - functions of carboxy peptidase A, zinc metalloenzyme – mechanism and uses, Zn-Cu enzyme - structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferridoxin, Iron sulphur cluster enzymes. Invivo and Invitro nitrogen fixation – biological functions of nitrogenase and molybdo enzymes.						

	UNIT IV Silicates <p>Introduction – general properties of silicates, structure – types of silicates – ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates(pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)</p>
	UNIT V Industrial Applications of Inorganic Compounds <p>Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, antiskinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels.</p> <p>Nanocomposite Hydrogels: synthesis, characterization and uses.</p> <p>Industrial visits and internship mandatory.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p> <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
Skills acquired from this course	
Recommended Text	<p>1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th ed., Milestone Publishers & Distributors, Delhi.</p>
	<p>2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi</p> <p>3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London.</p> <p>4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand and Company Ltd.</p> <p>5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992</p>

Reference Books	<ol style="list-style-type: none"> 1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded., S.Chand and Company, New Delhi. 2. Gopalan R, (2009) <u>Inorganic Chemistry for Undergraduates</u>, Ist Edition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) <u>Inorganic Chemistry</u>. Ist Edition, Pearson, Chennai 4. Alan G. Sharp (1992), <u>Inorganic Chemistry</u>, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website and e-learning source	<ol style="list-style-type: none"> 1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http://swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: ability to explain the importance of tracer elements on biological system.

CO2: explain the metal ion transport, Bohr effect, Na, K, Ca pump.

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

CO4: classification and structure of silicates.

CO5: explain the manufacture of refractories, explosives, paints and pigments

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3

CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

INORGANIC CHEMISTRY-II

Model Question Paper

SECTION A – ($10 \times 2 = 20$ marks)

Answer ALL questions

1. Mention the importance of macrominerals.
2. Mention the effect of excess intake of heavy metals in body.
3. What is the role of Transferrin and ferretin?
4. What drives the calcium pump in muscle cells?
5. What is the biological function of nitrogenase?
6. What is the activity of carboxypeptidase?
7. Write the general formula of zeolites.
8. Write the general properties of silicates.
9. What are the prerequisites of a good paint?
10. What is used as anti knocking agent? Mention its role

SECTION B – ($5 \times 5 = 25$ marks)

Answer ALL questions

11. a) Write the toxicity of metal ions lead, Arsenic and mercury.
Or
b) Mention the role of Zinc and Magnesium in biological systems
12. a) What is known as the Bohr effect?
Or
b) What is the function of sodium-potassium pump?
13. a) Explain the structure of cyanocobalamin.
Or
b) What is the enzyme form of vitamin B₁₂? Explain
14. a) Discuss the structure of pyro and chain silicates.

Or

- b) Write the properties of sheet silicates. Explain with an example.
15. a) What is the definition of a hydrogel? Explain the synthesis and uses of it.

Or

- b) What is the principle of plasticizers and binders? Give its application.

SECTION C – ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. What is the biological function of calcium, iron, copper, potassium and sodium?
17. Explain the structure and function of myoglobin and Haemoglobin.
18. What are the structural features and function of Rubredoxin and Ferridoxin?
19. Write notes on Feldspars and Ultramarines.
20. Write a note on refractory, explosives and pyrochemicals?

Title of the Course	PHYSICAL CHEMISTRY-II						
Paper No.	Core - XV						
Category	Core	Year	III	Credits	3	Course Code	
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	Physical Chemistry - I						
Objectives of the course	<p>The course aims at providing an overall view of the</p> <ul style="list-style-type: none">• phase diagram of one and two component systems• chemical equilibrium,• separation techniques for binary liquid mixtures.• electrical conductance and transport number.• galvanic cells, EMF and significance of electrochemical series.						
Course Outline	<p>UNIT-I Phase rule</p> <p>Definition of terms; derivation of phase rule ; application to one component systems – water and sulphur - super cooling, sublimation ; two component systems – solid liquid equilibria- simple eutectic (lead - silver and bismuth - cadmium), freezing mixtures (potassium iodide- water), compound formation with- congruent melting points (magnesium – zinc and ferric chloride – water system), peritectic</p>						

	change (sodium – potassium), solid solution (gold-silver); copper sulphate – water system.
	<p>UNIT II</p> <p>Chemical equilibrium</p> <p>Law of mass action – thermodynamic derivation – relationship between K_p and K_c – application to the homogeneous equilibria – dissociation of PCl_5 gas, N_2O_4 gas – equilibrium constant and degree of dissociation - formation of HI, NH_3 and SO_3 – heterogeneous equilibrium – decomposition of solid calcium carbonate – Lechatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – ClausiusClayperon equation and its applications</p>
	<p>UNIT III</p> <p>Binary liquid mixtures</p> <p>Ideal liquid mixtures – non ideal solutions – azeotropic mixtures – fractional distillation – partially miscible mixtures – phenol-water, triethylamine-water, nicotine-water – effect of impurities on critical solution temperature; immiscible liquids- steam distillation; Nernst distribution law – applications.</p>

	<p>UNIT IV Electrical Conductance and Transference Arrhenius theory of electrolytic dissociation – Ostwald’s dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. Ionic mobility – Discharge of ions on electrolysis (Hittorf’s theoretical device), transport number –determination – Hittorf’s method, moving boundary method – factors affecting transport number – determination of ionic mobility; Kohlrausch’s law- applications; molar ionic conductance and viscosity (Walden’s rule); applications of conductance measurements – determination of - degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility and solubility product of sparingly soluble salts - conductometric titrations – acid base titrations.</p> <p>UNIT V Galvanic Cells and Applications Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction, thermodynamics and EMF – calculation of ΔG, ΔH, and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electrochemical series. Chemical cells with and without transport, concentration cells with and without transport; Applications of EMF measurements applications of EMF measurements – determination of activity</p>
	<p>coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis; redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate.</p> <p>Industrial component Galvanic cells- lead storage, Ni-Cd, Li and Zn-air, Al-air batteries Fuel cells – H_2-O_2 cell – efficiency of fuel cells. corrosion –mechanism, types and methods of prevention.</p>

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.
Reference Books	<ol style="list-style-type: none"> 1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009. 2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001 5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand&Co., 2001
Website and e-learning source	https://nptel.ac.in https://swayam.gov.in https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf Thermodynamics - NPTEL https://www.youtube.com/watch?v=f0udxGcoztE Introduction to chemical equilibrium – MIT opencourse ware

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.

CO2: apply the concepts of chemical equilibrium in dissociation of PCl_5 , N_2O_4 and formation of HI , NH_3 , SO_3 and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation.

CO3: Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.

CO4: Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.

CO5: Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

PHYSICAL CHEMISTRY-II

Model Question Paper

SECTION A – ($10 \times 2 = 20$ marks)

Answer ALL questions

1. Define each term in phase rule.
2. What is reduced phase rule?
3. Give the relation between K_p and K_c
4. State Lechatelier principle.
5. Why alcohol and water can't be separated completely?
6. What is an advantage of partial immiscible liquids?
7. Define Kohlrausch's law.
8. What is wien effect?
9. Define standard electrode potential.
10. Give the applications of electrochemical series.

SECTION B – ($5 \times 5 = 25$ marks)

Answer ALL questions

11. a) Derive phase rule equation.

Or

- b) Write a Short note on freezing mixtures

12. a) Derive Clayperon-Clausius equation.

Or

- b) Discuss about heterogeneous equilibrium.

13. a) Discuss about fractional distillation.

Or

b) Discuss the effect of impurity on phenol-water system.

14. a) Discuss the determination of transport number by Hittorf's method.

Or

b) Derive Ostwald dilution law.

15. a) Derive Nernst equation for electrode potential.

Or

b) Discuss about concentration cell with transference.

SECTION C – ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. Explain the phase diagram of Bismuth-Cadmium system.
17. Derive Van't Hoff reaction isochore.
18. Discuss the applications of Nernst distribution law.
19. Explain the applications of conductance measurements.
20. How acid-base titration be carried out by potentiometric method.

Title of the Course	PHYSICAL CHEMISTRY PRACTICAL – II						
Paper No.	Core XVI						
Category	Core	Year	III	Credits	2	Course Code	
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	3		3		
Prerequisites	Theoretical knowledge on physical chemistry						
Objectives of the course	This course aims at providing <ul style="list-style-type: none">• basic principles of physical chemistry experiments• hands on experience in carrying out the experiments						
Course Outline	UNIT I Phase diagrams <ol style="list-style-type: none">1. Simple eutectic - determination of eutectic temperature and composition of naphthalene- diphenyl amine or naphthalene-diphenyl system2. Determination of transition temperature of a salt hydrate.3. Determination of upper critical solution temperature of phenol – water system4. Effect of an electrolyte on miscibility temperature of phenol – water system5. Determination of concentration of sodium chloride using phenol- sodium chloride system Unit II						
	Distribution law <ol style="list-style-type: none">6. Determination of the distribution coefficient of iodine between carbon tetrachloride and water.7. Determination of equilibrium constant of the reaction $\text{I}_2 + \text{I}^- \rightleftharpoons \text{I}_3^-$8. Determination of concentration of the given potassium iodide solution using the above equilibrium constant. UNIT III Electrochemistry <ol style="list-style-type: none">9. Conductometric titration of hydrochloric acid against sodium hydroxide10. Potentiometric titration of ferrous ion against potassium dichromate using quinhydrone electrode.						
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)						

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	1. Sindhu, P.S. <i>Practicals in Physical Chemistry</i> , Macmillan India : New Delhi, 2005. 2. Khosla, B. D. Garg, V. C.; Gulati, A. <i>Senior Practical Physical Chemistry</i> , R. Chand : New Delhi, 2011. 3. Gupta, Renu, <i>Practical Physical Chemistry</i> , 1 st Ed.; New Age International : New Delhi, 2017.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: Describe the principles and methodology for the practical work. CO2: Explain the procedure, data and methodology for the practical work CO3: Apply the principles of phase rule and electrochemistry for carrying out the practical work CO4: Demonstrate laboratory skills for safe handling of the equipment and chemicals	

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

SCHEME OF VALUATION

Internal assessment: 25 Marks

External assessment: 75 Marks

Total: 100 Marks

Record: 15 Marks

Experiment: 45 Marks

Manipulation, Tabulation and Calculation: 15 Marks

1) Effect of electrolyte on CST

Graph: 10
 Error upto 10 %: 35
 20 %: 25
 30 %: 15
 > 30: 10

2) Conductance

Equivalent conductance: 25 marks

Error upto 10 % : 25
 Upto 15 % : 15
 >15 % : 10

Cell constant : 20 marks

Error upto 10 % : 20
 Upto 15 % : 15
 >15 % : 10

3) Conductometric titration

Graph: 10
 Upto 2 % : 35
 2.1 to 3 % : 30
 3.1 to 4 % : 25
 4.1 to 5 % : 20
 > 5% : 15

6) Transition temperature

Graph: 10
 Error upto 2°C difference: 35
 7°C difference: 25
 > 7°C difference: 15

Title of the Course	FUNDAMENTALS OF SPECTROSCOPY						
Paper No.	EC VII						
Category	Elective Course	Year	III	Credits	3	Course Code	
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice			Total	
	4	1	-			5	
Prerequisites	General Chemistry I,II,III and IV						
Objectives of the course	<p>This course is designed to provide knowledge on</p> <ul style="list-style-type: none">• electrical and magnetic properties of organic and inorganic compounds• basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry• instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry• applications of various spectral techniques in structural elucidation• solving combined spectral problems						
Course Outline	<p>UNIT I</p> <p>Electrical and Magnetic properties of molecules</p> <p>Dipole moment – polar and nonpolar molecules – polarisability of molecules. Application of dipole moments in the study of organic and inorganic molecules.</p> <p>Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti ferromagnetism</p> <p>Microwave spectroscopy</p> <p>Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications</p>						

	<p>UNIT II Ultraviolet and Visible spectroscopy Electronic spectra of diatomic molecules (Born Oppenheimer approximation) - vibrational coarse structure – rotational fine structure of electronic vibration transitions – Frank Condon principle – dissociation in electronic transitions – BirgeSponer method of evaluation of dissociation energy – pre-dissociation transition - $\sigma - \sigma^*$, $\pi - \pi^*$, $n - \sigma^*$, $n - \pi^*$ transitions. Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α, β - unsaturated ketones. Elementary Problems. Colorimetry - principle and applications (estimation of Fe^{3+})</p>
	<p>UNIT III</p>
	<p>Infrared spectroscopy Vibration spectra –diatomic molecules – harmonic oscillator and anharmonic oscillator; Vibration – rotation spectra – diatomic molecule as rigid rotator and anharmonic oscillator (Born-Oppenheimer approximation oscillator) - selection rules, vibrations of polyatomic molecules – stretching and bending vibrations – applications – determination of force constant, moment of inertia and internuclear distance – isotopic shift – application of IR spectra to simple organic and inorganic molecules – (group frequencies)</p> <p>Raman Spectroscopy Rayleigh scattering and Raman scattering of light – Raman shift – classical theory of Raman effect – quantum theory of Raman effect – Vibrational Raman spectrum – selection rules – mutual exclusion principle – instrumentation (block diagram) – applications.</p> <p>UNIT IV Nuclear magnetic resonance spectroscopy: PMR – theory of PMR – instrumentation - number of signals – chemical shift – peak areas and proton counting – spin-spin coupling – applications. Problems related to shielding and deshielding of protons, chemical shifts of protons in hydrocarbons, and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems.</p>

	UNIT V Mass spectrometry Principle – different kinds of ionisation – instrumentation – the mass spectrum – types of ions – determination of molecular formula-fragmentation and structural elucidation – McLafferty rearrangement; Retro Diels Alder reaction - illustrations with simple organic molecules. Solving structure elucidation problems using multiple spectroscopic data (NMR, MS, IR and UV-Vis).
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	1. Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. <i>Elements of Analytical Chemistry</i> ; S Chand: New Delhi, 2003. 2. Usharani, S. <i>Analytical Chemistry</i> , 1 st ed.; Macmillan: India, 2002. 3. Banwell, C.N.; Mc Cash, E. M. <i>Fundamentals of Molecular Spectroscopy</i> , 4 th ed.; Tata McGraw Hill, New Delhi, 2017. 4. U.N.Dash, <i>Analytical Chemistry Theory and Practice</i> , Sultan Chand & Sons, 2 nd Ed., 2005 5. B.K.Sharma, <i>Spectroscopy</i> , 22 nd ed., Goel Publishing House, 2011.
Reference Books	1. Srivastava, A. K.; Jain, P. C. <i>Chemical Analysis an Instrumental Approach</i> , 3 rd ed.; S.Chand, New Delhi, 1997. 2. Robert D Braun. <i>Introduction to Instrumental Analysis</i> ; Mc.Graw Hill: New York, 1987. 3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. <i>Fundamentals of Analytical Chemistry</i> , 9 th ed.; Harcourt college Publishers: USA, 2013. 4. Madan, R. L.; Tuli, G. D. <i>Physical Chemistry</i> , 2 nd ed.; S.Chand: New Delhi, 2005. 5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. <i>Principles of Physical Chemistry</i> , 43 rd ed.; Vishal Publishing: Delhi, 2008.

Website and e-learning source	1. http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf 2. http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.html 3. www.epgpathshala.nic.in 4. www.nptel.ac.in 5. http://swayam.gov.in
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Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain electrical and magnetic properties of materials and microwave spectroscopy

CO2: explain theory, instrumentation and applications of Infrared and Raman spectroscopy

CO3: apply selection rules to understand spectral transitions, explain Woodward – Fieser’s rule for the calculation of wavelength maximum of conjugated dienes **CO4:** explain theory, instrumentation and applications of NMR spectroscopy

CO5: explain theory, instrumentation and applications of Mass spectrometry

	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	S	S	S	M	S	M
CO 2	M	S	S	S	M	S	S	M	M	M
CO 3	S	S	S	M	S	S	S	M	S	M
CO 4	S	S	S	S	S	S	S	M	M	M
CO 5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15

Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0
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Level of Correlation between PSO's and CO's

FUNDAMENTALS OF SPECTROSCOPY

Model Question Paper

SECTION A – ($10 \times 2 = 20$ marks)

Answer ALL questions

1. Define ferromagnetism and antiferromagnetism
2. What is mass susceptibility and molar susceptibility?
3. What is transition probability?
4. Write a note on symmetry restrictions in electronic transitions
5. What is the necessary condition for a molecule to absorb IR radiation?
6. Why strong bands in IR corresponds to weak bands in Raman and vice versa?
7. Calculate the number of multiplets in $\text{CH}_3\text{CH}_2\text{OCH}_3$.
8. Why C^{12} , O^{16} , S^{32} do not exhibit NMR spectra?
9. State basic principles of mass spectrometry
10. What is metastable ions or peaks?

SECTION B – ($5 \times 5 = 25$ marks)

Answer ALL questions

11. a) How will you determine magnetic susceptibility using guoy balance?

Or

- b) Mention the application of dipole moments in the study of organic and inorganic molecules.

12. a) What is Frank codon principle? On the basis of woodward rules, calculate the λ_{max} for

Or

b) Explain the principle and application of colorimetry.

13. a) How many fundamental vibrational frequencies would you expect to observe in the IR spectrum of CO_2 ?

Or

b) Explain Rayleigh scattering and Raman scattering.

14. a) What are the factors affecting the chemical shift?

Or

b) Explain splitting in 1,1 difluoro-1,2-dichloroethane.

15. a) Explain McLafferty rearrangement with suitable example

Or

b) Explain Retro-Diels Alder reaction in cyclohexene.

SECTION C – ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. How isotopic substitution in a molecule can affect the reaction rate? How do you find the bond length in rotational spectra?

17. What are the selection rules for electronic transitions? Explain the terms auxochrome, chromophore, Bathochromic shift and Hypsochromic shift.

18. Write the applications of IR spectroscopy.

19. How will you explain the following with suitable examples using NMR spectra (i) distinguish cis-trans isomers, (ii) keto-enol tautomerism (iii) detection of Hydrogen bonding.

20. Illustrate the general rules for predicting prominent peaks in mass spectrum.

Title of the Course	PROFESSIONAL COMPETENCY SKILL						
Paper No.	SEVIII						
Category	Skill Enhancement Course	Year	III	Credits	2	Course Code	
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-			2		
Prerequisites	General Chemistry						
Objectives of the course	The course aims at providing training to <ul style="list-style-type: none">develop professional skills in studentsto provide hands on experience to prepare and develop products						
Course Outline	UNIT I						
	General lab safety rules Common rules that relate to almost every laboratory - Safety policies - First aid - Use of fire safety - Use of laboratory hood.						
	Safe Handling of Hazardous Chemicals Introduction of hazardous chemicals - Rules for handling chemicals - Essential practices for handling hazardous chemicals - Laboratory waste management.						
	UNIT II						
	Applications of computers in chemistry basics Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions - Elements of the BASIC language - BASIC keywords and commands- Logical and relative operators.						

	UNIT III Principles of Qualitative and Quantitative Analysis Concentration and its expression (molality, molarity, normality Percentage and their calculations)- Standard solution – definition and examples for primary and secondary standard calculation of molecular weight and equivalent weight of acid, base, oxidation agent and salt
	UNIT IV Chromotography Introduction – classification – partition, adsorption, ion exchange and exclusions – principles, types – working and application – column, Thin layer, paper, HPLC, GLC chromatography – principle, techniques and applications
	UNIT V Professional skills Soft skills – communication skills, Teamwork skills, Time management, Problem solving, Decision making, Leadership skills, stress management, organization skills Hard skills – Basic computer skills, Customer service skills – presentation, marketing, team management, project design – Data analysis skills
	Skills acquired from this course
Recommended Text	Professionalskills. 1. Robert H. Hill Jr., David C. Finster, <i>Laboratory safety for chemistry students</i> (2016). 2. Harris, D. C. <i>Quantitative Chemical Analysis</i> . 6th Ed., Freeman (2007) Chapters 3-5.
Reference Books	Levie, R. de, how to use <i>Excel in analytical chemistry and in general scientific data analysis</i> , Cambridge Univ. Press (2001) 487 pages.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: identify adulterated food items by doing simple chemical tests. CO 2: prepare cleaning products and become entrepreneurs CO 3: educate others about adulteration and motivate them to become entrepreneurs.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
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CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
Weightage	6	6	6	6	6
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

ALLIED CHEMISTRY FOR PHYSICAL SCIENCES

Title of the Course	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	<div>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.</div>						
Course Outline	<div>UNIT I</div> <div>Chemical Bonding and Nuclear Chemistry</div> <div>Chemical Bonding: Molecular Orbital Theory-bonding, antibonding</div>						

	<p>and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.</p> <p>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.</p>
	<p>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.</p>
	<p>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.</p>
	<p>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 efficiency of heat engine. Entropy and its</p>

	<p>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.</p> <p>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).</p>
	<p>UNIT V Analytical Chemistry</p> <p>Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization.</p> <p>Chromatography: principle and application of column, paper and thin layer chromatography.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, NewDelhi, twenty third edition, 2012. 4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	<ol style="list-style-type: none"> 5. P.L.Soni, MohanKatyal, Textbook of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 6. B.R.Puri, L.R.Sharma, M.S.Pathania, Textbook Physical Chemistry; Vishal Publishing Co., New Delhi, forty fourth edition, 2018. 7. B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

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

- CO 1: gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.
 CO 2: evaluate the efficiencies and uses of various fuels and fertilizers
 CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
 CO 4: apply various thermodynamic principles, systems and phase rule.
 CO 5: explain various methods to identify an appropriate method for the separation of chemical components

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

CHEMISTRY FOR PHYSICAL SCIENCES I
(FOR MATHEMATICS & PHYSICS STUDENTS)

Time: 3 Hours

Max. Marks: 75

SECTION – A (10 X 2 = 20)

Answer ALL the questions.

1. What are isotopes? Give an example.
2. What is the bond order of nitrogen?
3. What is LPG?
4. Write any two applications of NPK fertilizer.
5. Chloroacetic acid is stronger than acetic acid. Why?
6. State Huckel's rule.
7. Write the mathematical statement of first law of thermodynamics.
8. What is phase rule?
9. What is R_f value?
10. Define crystallization.

SECTION – B (5 X 5 = 25)

Answer ALL the questions.

11. (a) Using MO diagram calculate the bond order of Helium.
Or
(b) Write notes on nuclear fission using suitable example.

12. (a) Write notes on Natural gas and water gas.
Or
(b) Write the preparation and uses of superphosphate and Urea.
13. (a) Explain the geometry of ethylene on the basis of hybridization.
Or
(b) Write the mechanism of Friedel-Craft's alkylation.
14. (a) Write the statements of second law of thermodynamics.
Or
(b) Explain the phase diagram of water system.
15. (a) Write notes on distillation.
Or
(b) Explain the principle and working of column chromatography.

SECTION – B (3 X 10 = 30)

Answer any THREE of the following questions.

16. Write the applications of radioisotopes.
17. Give Synthesis, properties and uses of silicones.
18. Explain hyperconjugation and steric effect with suitable example.
19. Explain the applications of a simple eutectic system using the phase diagram of Pb-Ag system.
20. Explain the principle, working and applications of Thin layer chromatography.

Title of the Course	CHEMISTRY FOR PHYSICAL SCIENCES II (FOR MATHEMATICS & PHYSICS STUDENTS)						
Paper No.	Generic Elective II						
Category	Generic Elective	Year	I	Credits	3	Course Code	
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	-	-		4		

Prerequisites	Chemistry for physical sciences -I
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 electrochemistry • basics and applications of kinetics and catalysis • Various photochemical phenomenon

Course Outline	<p>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 $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis.</p> <p>Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques- BOD, COD.</p>
	<p>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 interconversion. Properties of starch and cellulose.</p> <p>Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).</p>
	<p>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.</p>

	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).
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. 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.
Reference Books	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.

	3. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
Website and e-learning source	
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology CO 2: explain the preparation and property of carbohydrate, amino acids and nucleic acids. CO 3: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells. CO 4: identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst. CO 5: outline the various type of photochemical process.	

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's**CHEMISTRY FOR PHYSICAL SCIENCES II
(FOR MATHEMATICS & PHYSICS STUDENTS)**

Time: 3 Hours

Max. Marks: 75

SECTION – A (10 X 2 = 20)

Answer ALL the questions.

1. Give EAN rule.
2. What is BOD?
3. What are Carbohydrates? Give an example.
4. Write the preparation of alanine.
5. What are buffer solutions?
6. What is pH?
7. Define Half-life period.

0

8. Define Catalysis.
9. State Grothus-Draper's law
10. How will you calculate Quantum yield?

SECTION – B (5 X 5 = 25)

Answer ALL the questions.

11. (a) Explain the determination of hardness of water using EDTA method
Or
(b) Write the Biological role of Haemoglobin.
12. (a) Discuss about open chain ring structure of glucose.
Or
(b) Write the differences between RNA and DNA.
13. (a) Explain the determination of pH by colorimetric method
Or
(b) Elaborate about Nickel and chrome plating.
14. (a) Derive rate expression for first order kinetics.
Or
(b) Explain the concept of energy of activation.
15. (a) Write the differences between Phosphorescence and fluorescence.

Or
(b) How will you calculate quantum yield for Hydrogen-Chlorine reaction.

SECTION – B (3 X 10 = 30)

Answer any THREE of the following questions.

16. Write Postulates of Pauling's theory and apply it for $[\text{Ni}(\text{CN})_4]^{2-}$
17. Write the preparation of dipeptides using Bergmann method.
18. Write notes on Conductometric titrations.
19. Give any two methods of determining order of a reaction.
20. Explain about photosensitization and photosynthesis.

ALLIED CHEMISTRY FOR BIOLOGICAL SCIENCES

Title of the Course	CHEMISTRY FOR BIOLOGICAL SCIENCES I (FOR BOTANY AND ZOOLOGY STUDENTS)						
Paper No.	Generic Elective III						
Category	Generic Elective	Year	II	Credits	3	Course Code	
		Semester	III				
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</p> <ul style="list-style-type: none"> • basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry • nuclear chemistry and industrial chemistry • importance of speciality drugs and • separation and purification techniques.
Course Outline	<p>UNIT I Chemical Bonding and Nuclear Chemistry</p> <p>Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.</p> <p>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.</p> <p>Unit II Industrial Chemistry</p> <p>Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).</p> <p>Silicones: Synthesis, properties and uses of silicones.</p> <p>Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.</p> <p>UNIT III Fundamental Concepts in Organic Chemistry</p> <p>Hybridization: Orbital overlap hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆. Polar effects: Inductive effect and</p>

	<p>consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation.</p> <p>Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.</p> <p>Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.</p> <p>UNIT IV Drugs and Speciality Chemicals Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.</p> <p>UNIT V: Analytical Chemistry Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	<ol style="list-style-type: none"> 1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012. 4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	<ol style="list-style-type: none"> 1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. 3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: state the theories of chemical bonding, nuclear reactions and its applications. CO 2: evaluate the efficiencies and uses of various fuels and fertilizers. CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions. CO 4: demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars. CO 5: analyse various methods to identify an appropriate method for the separation of chemical components.	

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

Allied Chemistry Model Question paper

(For Bot. and Zoo)

Second Year III Semester

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

1. What are isotopes?
2. What is carbon dating?
3. Write two uses of silicones.
4. Write the composition of oil gas.
5. Write an inductive effect and its consequences on the dissociation constant of organic acids.
6. Give an example for electrophile.
7. Write the structure of Penicillin.
8. What are Antipyretics?
9. Which indicator is used in the titration of strong acid vs weak base?
10. Write a stationary phase in paper chromatography.

SECTION B – (5 × 5 = 25 marks)

Answer ALL questions

11. a. Differentiate between Nuclear fusion and fission.
(or)
b. Write a note on applications of radioisotopes.
12. a. Write about NPK fertilizers.
(or)
b. Write a short note on water and producer gas.
13. a. Discuss the mechanism of Nitration of benzene.
(or)
b. Explain the preparation and properties of pyrrole.
14. a. Write about artificial sweetener.
(or)
b. Write about Teflon and Freon.
15. a. Write principle and applications of column chromatography.

(or)

b. Write about any two separation technique.

SECTION C – ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. Explain MO diagram of Nitrogen.
17. Discuss the preparation and properties of silicones.
18. Explain the mechanism of Friedel-Craft alkylation and acylation.
19. Explain the structure and uses of Chloramphenicol.
20. Explain the principle, technique and application of thin layer chromatography.

Title of the Course	CHEMISTRY FOR BIOLOGICAL SCIENCES II (FOR BOTANY AND ZOOLOGY STUDENTS)						
Paper No.	Generic Elective IV						
Category	Generic Elective	Year Semester	II IV	Credits	3	Course Code	
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	-	-		4		
Prerequisites	Chemistry for Biological Sciences I						
Objectives of the course	This course aims to provide knowledge on <ul style="list-style-type: none">• nomenclature of coordination compounds and carbohydrates.• Amino Acids and Essential elements of biosystem• understand the concepts of kinetics and catalysis• provide fundamentals of electrochemistry and photochemistry						
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 $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques – BOD and COD.						
	Unit II Carbohydrates Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion. Preparation and properties of sucrose, starch and cellulose.						

	<p>UNIT III</p> <p>Amino Acids and Essential elements of biosystem</p> <p>Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins-classification - structure - Colour reactions - Biological functions - nucleosides nucleotides - RNA and DNA - structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.</p>
	<p>UNIT IV</p> <p>Electrochemistry</p> <p>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.</p>
	<p>UNIT V</p> <p>Photochemistry</p> <p>Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen -chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	<ol style="list-style-type: none"> 1. V.Veeraian, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. 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.
Reference Books	<ol style="list-style-type: none"> 1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007. 3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology. CO 2: explain the preparation and property of carbohydrate. CO 3: enlighten the biological role of transition metals, amino acids and nucleic acids. CO 4: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells. CO 5: outline the various type of photochemical process.	

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

Allied Chemistry Model Question paper

(For Bot. and Zoo)

Second Year IV Semester

SECTION A – (10 × 2 = 20 marks)

Answer ALL questions

1. Give the IUPAC names of $[\text{Ni}(\text{CN})_4]^{2-}$ and $[\text{Ni}(\text{CO})_4]$.
2. Write any two disadvantages of hard water.
3. Write the ring structures of glucose and fructose.
4. How are carbohydrates classified?
5. Give one method of preparation of alanine.
6. Write one biological role of Copper.
7. Define standard Electrode potential.
8. What are fuel cells?
9. Define Quantum yield.
10. State Stark-Einstein's Law.

SECTION B – (5 × 5 = 25 marks)

Answer ALL questions

11. a. Write an account on the biological role of hemoglobin and chlorophyll.
(or)
b. Write a note on BOD and COD.
12. a. Discuss inter-conversion of glucose into fructose and vice versa.
(or)
b. Write a short note on properties of Sucrose.
13. a. Differentiate between DNA and RNA.
(or)
b. Discuss the biological role of trace elements – Zn and Fe.
14. a. Elaborate the preventive methods of corrosion.

(or)

b. How ionic product of water is determined by conductometric method?

15. a. Discuss and differentiate between phosphorescence and fluorescence.

(or)

b. Write short note on photosensitization and photosynthesis.

SECTION C – ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. Explain in detail how hardness of water is determined using EDTA method?

17. Discuss the preparation and properties of Cellulose.

18. Explain Bergmann method of synthesis of peptides.

19. What are buffer solutions and discuss its biological applications.

20. Explain the mechanism and kinetics of photochemical reaction between hydrogen and chloride.

Title of the Course	CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES (for Mathematics and Physics – I Year/I Semester; for Botany and Zoology II Year/III Semester)						
Paper No.	Generic Elective V						
Category	Generic Elective	Year	I/ II	Credits	1	Course Code	
		Semester	I/III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	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 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, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.						
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO 2: design, carry out, record and interpret the results of volumetric titration. CO 3: apply their skill in the analysis of water/hardness. CO4: analyze the chemical constituents in allied chemical products							
CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	3	3	3	3	3		
CO2	3	3	3	3	3		
CO3	3	3	3	3	3		
CO4	3	3	3	3	3		

Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

SCHEME OF VALUATION
CHEMISTRY PRACTICAL FOR PHYSICAL AND
BIOLOGICAL SCIENCES

(for Mathematics and Physics – I Year/I Semester; for Botany and Zoology II Year/III Semester)

Internal assessment: 25 Marks

External assessment: 75 marks

Total: 100 marks

Max. Marks: 75

Record: 15 Marks

Volumetric Analysis: 60 Marks

Volumetric Analysis : 60 Marks (Maximum)

Short Procedure : 10 Marks

Error upto 2 % : 50 Marks

2 to 3 % : 40 Marks

3 to 4 % : 30 Marks

4 to 5 % : 20 Marks

> 5 % : 10 Marks

Arithmetic error : Deduct 1 mark

Wrong calculation : Deduct 20 % of marks scored

No calculation : Deduct 40 % of marks scored

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Title of the Course	CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES (For Mathematics and Physics – I year/II semester; For Botany and Zoology II year/IV semester)						
Paper No.	Generic Elective VI						
Category	Generic Elective	Year	I/ II	Credits	1	Course Code	
		Semester	II/IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	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..						
	SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS The analysis must be carried out as follows:						
	<p>(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].</p> <p>(b) Detection of elements (N, S, Halogens).</p> <p>(c) To distinguish between aliphatic and aromatic compounds.</p> <p>(d) To distinguish – Saturated and unsaturated compounds.</p>						
Reference Books	V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.						
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO 2: design, carry out, record and interpret the results of volumetric titration. CO 3: apply their skill in the analysis of water/hardness. CO4: analyze the chemical constituents in allied chemical products							

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

SCHEME OF VALUATION
CHEMISTRY PRACTICAL FOR PHYSICAL AND
BIOLOGICAL SCIENCES

(For Mathematics and Physics – I year/II semester; For Botany and Zoology II year/IV semester)

Internal assessment: 25 Marks

External assessment: 75 marks

Total: 100 marks

Max. Marks: 75

Record: 15 Marks

Organic Analysis: 60 Marks

Organic Analysis: 60 Marks

Preliminary Test: 8 Marks

Aliphatic or Aromatic: 7 Marks

Saturated or unsaturated: 7 Marks

Tests for elements: 9 Marks

Confirmation Tests: 12 Marks

Functional groups: 10 Marks

Derivative/Coloured reaction: 7 Marks.

DEPARTMENT OF CHEMISTRY
PROGRAMME SPECIFIC OUTCOMES

On successful completion of the programme the students will be able to

- PSO1:** acquire in-depth knowledge of the fundamental concepts in all disciplines of chemistry.
- PSO2:** disseminate the basics of chemistry and advanced topics and analytical skills in organic, inorganic and physical chemistry.
- PSO3:** uphold ethical values in personal life, research and career.
- PSO4:** demonstrate laboratory skills, analytical acumen, creatively in academics and research.
- PSO5:** apply digital tools to collect, analyze and interpret data and presents scientific findings.
- PSO6:** gain competence to pursue higher education and career opportunities in chemistry and allied fields.
- PSO7:** exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.
- PSO8:** apply the concepts of chemistry to solve problems in the community, entrepreneurial and research pursuits.
- PSO9:** exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community.
- PSO10:** display proactive approach towards sustainable environment through green laboratory practices.

PO-PSO MAPPING MATRIX:

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
POs										
PO1	X									
PO2		X								
PO3			X							
PO4				X						
PO5					X					
PO6						X				
PO7							X			
PO8								X		
PO9									X	
PO10										X

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