APPENDIX - AO

MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

B.Sc. CHEMISTRY (SEMESTER)

(This will come into effect from the Academic Year 2023-24)

COURSE SCHEME & SCHEME OF EXAMINATIONS

Introduction of the Programme:

The study of science should be fascinating and enjoyable; the creation of a scientific temper in society is a must which could be achieved through proper education and guidance. To realize this goal, the curriculum should be updated by giving emphasis on various aspects such as the creativity of students, knowledge of emerging trends in the discipline, awareness of environmental impacts due to the development of science and technology, and the skills essential for handling equipments and instruments in laboratories and industries.

Chemistry, being an experimental science, demands testing theories through practical laboratory experiences for a thorough understanding of the subject. The syllabus has been prepared in a participatory manner, after discussions with all stakeholders.

Care has been taken to ensure that the syllabus is well-matched with the syllabi of other universities at the same level. Sufficient emphasis is given in the syllabus for training in laboratory skills and instrumentation. The units of the syllabus are well defined. A list of reference books as well as text books is provided at the end of each course.

Eligibility for admission:

Pass in Higher Secondary Examination with Chemistry, Physics and Mathematics/Zoology as core subjects or any other examination accepted by the Syndicate of Madurai Kamaraj University as Equivalent

Duration of the Course : 3 Years

Medium of Instructions : English /

TamilObjectives of the Programme:

- To impart fundamental knowledge in the field of Chemistry
- The theory and practical aspects of the subject augment the ability of the learner to understand the implications of scientific and technical approaches involved in the domain of knowledge

- To mould the learner into a prospective skillful scientific workforce for the future
- Study of Skill based papers and Industrial visit help mutual collaboration

Outcome of the programme:

A candidate after successfully completing the B.Sc degree in Chemistry becomes eligible:

- to pursue post graduate course in various branches of chemistry
- to appear in UPSC and other competitive examinations
- to get employment opportunities in chemical industries like sugar factory, paperindustry, tanneries etc
- can become an entrepreneur by setting up small scale industries.

Core Courses:

Core Course	Semester	Subject / Title of the Paper
CC 1	I	General Chemistry I
CP 1	I	Core Practical I
CC 2	II	General Chemistry II
CP 2	II	Core Practical II
CC 3	III	General Chemistry III
CP 3	III	Core Practical III
CC 4	IV	General Chemistry IV
CP 4	IV	Core Practical IV
CC 5	V	Organic Chemistry I
CC 6	V	Inorganic Chemistry I
CC 7	V	Physical Chemistry I
CP R	V	Core Project
CC 8	VI	Organic Chemistry II
CC 9	VI	Inorganic Chemistry II
CC 10	VI	Physical Chemistry II
CP 5	VI	Core Practical V

Skill Enhancement Course:

Skill based Subject	Semester	Subject / Title of the Paper
SEC1	II	Cosmetics and Personal Care Products
SEC2	III	Entrepreneurial Skills in Chemistry
SEC3	III	Pesticide Chemistry
SEC4	IV	Instrumental Methods of Chemical Analysis (Theory)
SEC5	IV	Forensic Science

Non Major Elective (offered by Chemistry Department for other major students):

NME	Semester	Subject / Title of the Paper
NME1	I	Food Chemistry
NME2	II	Dairy Chemistry

Naan Mudhalvan Skill Courses :

NMSC	Semester	Subject / Title of the Paper
NMSC 1	II	Language Proficiency for Employability
NMSC 2	IV	Digital Skills for Employability
NMSC 3	VI	Employability Readiness

Pattern of Semester Examinations:

The course consists of SIX semesters. For the Theory papers of I/III/V semesters, examinations areheld in NOVEMBER/ DECEMBER and for II/IV/VI semesters in APRIL/MAY months.

Scheme for Internal Assessment:

Test	10 Marks (average of the best two tests)
Assignment	5 Marks
Seminar/ Group discussion	5 Marks
Peer-Team –Teaching*	5 Marks
Total	25 Marks

*A minimum of 10% of the syllabus of all subjects shall be through the peer-team-teachingmethodby appropriate allocation of teaching hours

External Exam:

External Examination –Maximum 75 marks

QUESTION PAPER PATTERN

Time 3 Hours **Max. Marks 75**

Section	Question type	Number of questions to be answered	Marks for each question	Total Marks
A Q. No. 1 - 10	10 Objective questions(Two from each unit) Choose the correct answer from given choices a, b, c and d	10	1	10
B Q. No. 11 - 15	5 Either or type questions (One from each unit with internal choice)	5	7	35
C Q No.16 - 20	Descriptive (One from each unit)	3	10	30

Scheme of evaluation:

The University constitutes a panel of examiners on the basis of seniority. The senior most teacher shall act as the Chairman of valuation board. There shall be Chief examiners and Additional examiners under him. Each Chief examiner shall revalue 50% of papers valued by additional examiners. The Scheme of Valuation will be strictly adhered.

Candidates who pass all the examinations prescribed for the course in the first attempt and within a period of three academic years from the year of admission to the course alone are eligible for University Ranking.

Passing minimum

A candidate has to secure a minimum of 40 marks out of 100 marks for passing a paper. (External: Minimum 27 out of 75 marks for theory papers; Minimum of 21 out of 60 marks in the practical papers)

Note: There is no passing minimum for internal assessment marks.

Classification

Those candidates who secure 75% and above marks shall be declared as passed in First Class with distinction

Those candidates who secure 60% and above marks shall be declared as passed in First Class

Those candidates who secure 50% and above but less than 60% marks shall be declared as passed in Second Class

Those candidates who secure less than 50% shall be declared as passed in Third Class

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

PROGRAMME OUTCOMES (PO) OF B.SC DEGREE PROGRAMME IN

CHEMISTRY

- Students will possess basic subject knowledge required for higher studies, professional andapplied courses
- Students will acquire basic Practical skills & Technical knowledge along with domainknowledge of different subjects in the science & humanities stream.
- Students will develop scientific aptitude Integrate skills of analysis, critiquing, application andcreativity.
- Students will employ appropriate digital tools and techniques necessary in analysing data andcreative design.
- Students will gain competence to pursue higher learning, research and careers or will be able toopt for entrepreneurship
- Students will interact meaningfully with others displaying leadership and coordination inexecuting projects.
- Students will demonstrate responsibility as citizens committed to national developmentthrough community outreach, wellness of self and a sustainable environment.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Students acquire in-depth knowledge of the fundamental concepts in all disciplines ofchemistry.

PSO2: Students can disseminate the basics of chemistry and advanced topics and analyticalskills in organic, inorganic and physical chemistry.

PSO3: Students will be able develop creativity in academics and research.

PSO4: Students will be able apply digital tools to collect, analyse and interpret data and presentscientific findings.

PSO5: gain competence to pursue higher education and career opportunities in chemistry andallied fields.

PSO6: exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.

PSO7: apply the concepts of chemistry to solve problems in the community, entrepreneurial andresearch pursuits.

PSO8: exhibit competence in educational, industrial and research pursuits that contributetowards the holistic development of self and community.

- **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, enable the students to provide solutions to industry / real life situations. The curriculum also facilitates peer learning and research aptitude in the final semester by providing an opportunity do a project.
  - The General Studies and Chemistry 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 Industrial internship is newly introduced in the fourth semester,to expose the students to real life working environment and train the students to face challenges
  - The Internship during the second year vacation will help the students gain valuable work
  - 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 an experiment collecting and interpreting data and finally presenting the findings 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 - Nanoscience

Value additions in the Revamped Curriculum:

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 chemistry.	• Instil confidence among students • Create interest for the subject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to makethem employable
		• Training on entrepreneurial skills enable the students to gain knowledge and make them ready for start-up. • Provides an opportunity for independent livelihood. • Generates self – employment. • Creates small scale entrepreneurs. • Training to girls leads to women empowerment.
		• Skill enhancement courses help the students to gain internships, apprenticeships, field work involving data collection, compilation, analysis etc. • Enables the students to learn the operations of instruments. • Improves self-confidence. • Learns different analytical techniques.
		• Discipline specific course helps to recognise, identify, examine and testify any and every kind of physical evidence mostly found in crime scenes. • It improves the technical knowhow of solving real life problems.

I, II, III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• 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, physics and mathematics. • Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training. • Exposure to industry moulds students into solutionproviders. • Generates Industry ready graduates. • Employment opportunities enhanced.
II year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V	Project with Viva – voce	• Self-learning is enhanced. • Application of the concept to real situation is conceived resulting in tangible outcome. • Helps to explore industries and to have first-hand experience in industrial background.(when students carry out projects in industries) • Instil confidence and problem solving approach.
VI	Introduction of Professional Competency component	• Curriculum design accommodates all category of learners; 'Training for Competitive Examinations' – caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, NDA, Banking Services, CAT, JAM, TNPSC group services, etc.
Extra Credits: **For Advanced Learners / Honors degree**		• To cater to the needs of peer learners / researchaspirants

Template for Curriculum Design for UG Programme in

ChemistryCredit Distribution for UG Programme in Chemistry

B.Sc Chemistry
First Year

Semester-I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC1, CC2)	8	10
	Elective Course 1 (Generic / Discipline Specific)EC1	3	4
	Skill Enhancement Course SEC-1 (Non Major Elective)	2	2
Part-IV	Foundation Course FC	2	2
	Ability Enhancement Compulsory Course(AECC 1) Soft Skill-1	2	2
		23	**30**

Semester-II

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC3, CC4)	8	10
	Elective Course 1 (Generic / Discipline Specific) EC2	3	4
	Skill Enhancement Course -SEC-2 (Non Major Elective)	2	2
Part-IV	Skill Enhancement Course -SEC-3 (Discipline Specific / Generic)	2	2
	Ability Enhancement Compulsory Course(AECC 2) Soft Skill-2	2	2
		23	**30**

Second Year
Semester-III

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC5, CC6)	8	9
	Elective Course 1 (Generic / Discipline Specific)EC3	3	4
Part-IV	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline Specific/ Generic)	2	2
	Ability Enhancement Compulsory Course(AECC 3) Soft Skill-3	2	2
	Environmental Studies(EVS)	2	2
		24	**30**

Semester-IV

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC7, CC8)	8	8
	CC7: Core Industry Module -1		
	CC8 : Any Core paper		
Part-IV	Elective Course 1 (Generic / Discipline Specific)EC4	3	6
	Skill Enhancement Course -SEC-6	2	2
	Skill Enhancement Course -SEC-7 (Discipline Specific / Generic)	2	2
	Ability Enhancement Compulsory Course(AECC 4) Soft Skill-4	2	2
		23	**30**

Part	**List of Courses**	**Credit**	**Hours per week (L/T/P)**
Part-III	Core Courses 3(CC9, CC10, CC11)	12	15
	Elective Courses 2 (Generic / Discipline Specific) EC5, EC6	6	9
	Core /Project with Viva voce CC12	4	4
Part-IV	Value Education	2	2
	Internship / Industrial Training (Carried out in II Year Summervacation) (30 hours)	2	
		26	**30**

Third Year

Semester-V

Semester-VI

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Core Courses 3 (CC13, CC14, CC15)	12	15
	Elective Courses 2 (Generic / Discipline Specific) EC7, EC8	6	11
Part IV	Professional Competency Skill Enhancement Course SE8	2	4
Part-V	Extension Activity (Outside college hours)	1	-
		21	**30**

Credit Distribution for UG Programme in Chemistry

Sem I	Credit	Sem II	Credit	Sem III	Credit	Sem IV	Credit	Sem V	Credit	Sem VI	Credit	
1.1. Language	3	2.1. Language	3	3.1. Language	3	4.1. Language	3	5.1 Core Course – \CC IX	4	6.1 Core Course – CC XIII	4	
1.2 English	3	2.2 English	3	3.2 English	3	4.2 English	3	5.2 Core Course – CC X	4	6.2 Core Course – CC XIV	4	
1.3 Core Course – CC I	4	2.3 Core Course – CC III	4	3.3 Core Course – CC V	4	4.3 Core Course – CC VII Core Industry Module	4	5. 3.Core Course CC -XI	4	6.3 Core Course – CC XV	4	
1.4 Core Course – CC II	4	2.4 Core Course – CC IV	4	3.4 Core Course – CC VI	4	4.4 Core Course – CC VIII	4	5. 3.Core Course – / Project with viva-voce CC -XII	4	6.4 Elective -VII Generic/ Discipline Specific	3	
1.5 Elective I Generic/ Discipline Specific	3	2.5 Elective II Generic/ Discipline Specific	3	3.5 Elective III Generic/ Discipline Specific	3	4.5 Elective IV Generic/ Discipline Specific	3	5.4 Elective V Generic/ Discipline Specific	3	6.5 Elective VIII Generic/ Discipline Specific	3	
1.6 Skill Enhancement Course SEC-1 (NME)	2	2.6 Skill Enhancement Course SEC-2 (NME)	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	4.6 Skill Enhancement Course SEC-6	2	5.5 Elective VI Generic/ Discipline Specific	3	6.6 Extension Activity	1	

		2.7 Skill Enhancement Course –SEC-3	2	3.7 Skill Enhancement Course SEC-5	2	4.7 Skill Enhancement Course SEC-7	2	5.6 Value Education	2	6.7 Professional Competency Skill	2	
1.7Ability Enhancement Compulsory Course (AECC) Soft Skill-1	2	2.8 Ability Enhancement Compulsory Course (AECC) Soft Skill-2	2	3.7 Ability Enhancement Compulsory Course (AECC) Soft Skill-3	2	4.7 7Ability Enhancement Compulsory Course (AECC) Soft Skill-4	2	5.5 Summer Internship /Industrial Training	2			
1.8 Skill Enhancement - (Foundation Course)	2			3.8 E.V.S	2	4.8 E.V.S						
	23		**23**		**24**		**23**		**26**		**21**	
	Total Credit Points										**140**	

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	11	11	11	11	22	18	84
Part IV	6	6	5	8	4	2	31
Part V	-	-	-	-	-	1	1
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**

B.Sc Chemistry

Curriculum Design

First Year

Semester- I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	General Chemistry–I CC 1	5	5
	Quantitative Inorganic estimation (titrimetry) and Inorganic Preparations CP 1	2	3
	Mathematics (or)Botany /Zoology EC1	4	6
	Skill Enhancement Course - Non Major Elective 1	2	2
Part-IV	Foundation Course FC	2	2
	Ability Enhancement Compulsory Course(AECC) Soft Skill-1	2	2
		23	**30**

Semester-II

Part		Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	General Chemistry–II CC 2	5	5
	Qualitative Organic Analysis and preparation of Organic Compounds CP 2	2	3
	Mathematics (or)Botany /Zoology EC 2	4	6
Part-IV	Skill Enhancement Course NME 2	2	2
	Skill Enhancement Course SEC 1 (Discipline Specific): Cosmetics and Personal care Products	2	2
	Ability Enhancement Compulsory Course(AECC)Soft Skill-2 NMSC 1 - Language Proficiency for Employability - Effective English	2	2
		23	**30**

Second Year
Semester-III

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	General Chemistry–III CC 3	5	5

	Qualitative Inorganic Analysis CP3	2	3
	Physics EC 3	4	5
Part-IV	Skill Enhancement Course SEC 2 : Entrepreneurial skills in Chemistry	1	1
	Skill Enhancement Course SEC-3: (Discipline Specific) Pesticide Chemistry	2	2
	Ability Enhancement Compulsory Course(AECC) Soft Skill-3	2	2
	EVS	2	2
		24	**30**

Semester-IV

Part	**List of Courses**	**Credit**	**Hours per week (L/T/P)**
Part-I	Language	3	6
Part-II	English	3	4
Part-III	General Chemistry–IV CC 4	4	4
	Physical Chemistry Practical- I CP 4	3	4
	Physics EC 4	4	6
Part-IV	Skill Enhancement Course SEC-4 : Instrumental methods of Chemical Analysis (Theory)	2	2
	Skill Enhancement Course SEC-5: (Discipline Specific) Forensic Science	2	2
	Ability Enhancement Compulsory Course(AECC) SoftSkill-4 NMSC 2 - Digital Skills for Employability - Office Fundamentals	2	2
		23	**30**

Third YearSemester V

Part	**List of Courses**	**Credit**	**Hours per week (L/T/P)**
Part-III	Organic Chemistry -I CC 5	4	5
	Inorganic Chemistry - I CC 6	4	4
	Physical Chemistry -I CC 7	4	5
	Biochemistry EC5	3	4
	Industrial Chemistry EC 6	3	4

	Project with viva-voce CP R	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 CC 8	3	5
	Inorganic Chemistry - II CC 9	3	4
	Physical Chemistry -II CC 10	4	5
	Physical Chemistry Practical II CP 5	2	3
	EC7 Fundamentals of Spectroscopy	3	5
	EC 8Nanoscience/Polymer science/ Pharmaceutical Chemistry (Elective based)	3	4
Part IV	Professional Competency Skill NMSC 3 - Employability readiness	2	4
Part V	Extension Activity	1	-
		21	**30**

Title of the Course Paper No.	**GENERAL CHEMISTRY-I** **Core Course - CC 1**						
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	The course aims at giving an overall view of the • various atomic models and atomic structure • wave particle duality of matter • periodic table, periodicity in properties and its application in explaining thechemical 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; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom;The Franck-Hertz Experiment; Interpretation of H-spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De-Broglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli'exclusion principle and Aufbau principle; Numerical problems involving the core concepts**.** **Unit II** **Introduction to Quantum mechanics** Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wavefunctions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2. **Modern Periodic Table** **Cause of periodicity**; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity.
	UNIT-III: Structure and bonding - I **Ionic bond** Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarisation – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts.
	Covalent bond
	Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7

	Partial ionic character of covalent bond-dipole moment, application to molecules of the type A_2, AB, AB_2, AB_3, AB_4; percentage ionic character-numerical problems based on calculation of percentage ionic character. **UNIT-IV: Structure and bonding - II** VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, CO_3^{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; magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of BF_3, NH_3, NH_4^+, H_3O^+ properties Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points.
	UNIT-V: **Basic concepts in Organic Chemistry and Electronic effects** Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects.
	Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance. Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane Types of organic reactions- addition, substitution, elimination and rearrangements

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 and 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	• Madan, R. D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nded.; S.Chand and Company: New Delhi, 2003. • Rao, C.N. R. University General Chemistry, Macmillan Publication: NewDelhi, 2000. • Puri, B. R. and Sharma, L. R. *Principles of Physical Chemistry*, 38thed.;Vishal Publishing Company: Jalandhar, 2002. • Bruce, P. Y. and PrasadK. J. R. *Essential Organic Chemistry*, PearsonEducation: New Delhi, 2008. • Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi,2016
Reference Books	• Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*,4thed.; The Macmillan Company: Newyork,1972. • Lee, J. D. *Concise Inorganic Chemistry,* 4th ed.; ELBS William Heinemann: London,1991. • Gurudeep Raj, *Advanced Inorganic Chemistry*, 26thed.; Goel Publishing House: Meerut, 2001. • Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford University Press:New York, 2014. • Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed .; Addison, Wesley Publishing Company: India,1993.
Website and e-learning source	• https://onlinecourses.nptel.ac.in • http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm • http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html • https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding • 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'

Title of the Course	**Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations**						
Paper No.	**Core Practical - CP 1**						
Category	**Core**	**Year Semester**	I I	**Credits**	2	**Course Code**	
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	-	-	3			3	
Prerequisites	Higher secondary chemistry						

Objectives of the course	This course aims at providing knowledge on • laboratory safety • handling glasswares • Quantitative estimation • preparation 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
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text **Reference Books**	**Reference Books:** • Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. *Basic Principles ofPractical Chemistry*,2nd ed.; Sultan Chand &Sons: New Delhi, 1997. • Nad, A. K.; Mahapatra, B.; Ghoshal, A.; *An advanced course in Practical Chemistry*, 3rd ed.; New Central Book Agency: Kolkata, 2007. 1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; *Vogel's Textbook of Quantitative Chemical Analysis*, 6th ed.; Pearson Education Ltd: New Delhi, 2000.
Website and e-learning source	**Web References:** • http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis • 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

Title of the Course	**FOOD CHEMISTRY**						
Paper No.	**NME 1**						
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 - Cyclomate a n d 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 heartdiseases-determination of iodine value,RM value,saponification values and their significance.

Recommended Text	• Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house,2010. • Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand& Co.Publishers, second edition, 2006. • Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishning house,2010. • Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022. • Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Pdmini S Ghugre, New age international publishers, second edition, 2021.
Reference Books	• H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4th Edition, 2009. • M.Swaminathan, Food Science and Experimental Foods, Ganesh andCompany,1979. • Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and theirapplications Springer New York 2nd ed. 2008. • Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourthrevised and extended edition, 2009. • Principles of food chemistry, John M. deMan, John W. Finley, W. JeffereyHurst, 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, Cyclomate 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

<table>
<tr><td>Title of the Course</td><td colspan="6">ROLE OF CHEMISTRY IN DAILY LIFE</td></tr>
<tr><td>Paper No.</td><td colspan="6">Foundation Course (FC)</td></tr>
<tr><td>Category</td><td>FC</td><td>Year
Semester</td><td>I
I</td><td>Credits</td><td>2</td><td>Course Code</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture
2</td><td>Tutorial
-</td><td colspan="2">Lab Practice
-</td><td colspan="2">Total
2</td></tr>
<tr><td>Prerequisites</td><td colspan="6">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="6">This course aims at providing an overall view of the
• importance of Chemistry in everyday life
• chemistry of building materials and food
• chemistry of Drugs and pharmaceuticals</td></tr>
<tr><td>Course Outline</td><td colspan="6">UNIT-I

General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution</td></tr>
<tr><td></td><td colspan="6">Unit-II

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

	UNIT-III Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins (sources and their physiological importance). Cosmetics – tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes - general formulation and preparations - possible hazards of cosmetic use. **UNIT-IV** Chemicals in food production – fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate. Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses. **UNIT-V** Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.

Recommended Text	• Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. • A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012. • S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. • B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019. • Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006.
Reference Books	1.Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourthedition, 1977. 2.W.A.Poucher,JosephA.Brink,Jr.Perfumes,Cosmetics and Soaps,Springer, 2000. 3. A.K.De,EnvironmentalChemistry,NewAge InternationalPublicCo.,1990.
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

CO1: learn about the chemicals used in everyday life as well as air pollution and water pollution.

CO2: get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC bakelite, polyesters,

CO3: acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats Also have an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.

CO4: discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses

CO5: have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.

	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

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course - CC 2</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>5</td><td>Course Code</td><td></td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture
4</td><td>Tutorial
1</td><td colspan="3">Lab Practice
-</td><td>Total
5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing an overall view of the
• 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</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I

Acids, bases and Ionic equilibria
Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept,</td></tr>
<tr><td></td><td colspan="7">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.</td></tr>
<tr><td></td><td colspan="7">Unit-II

Chemistry of s - Block Elements
Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na_2CO_3, KBr, $KClO_3$ alkaline earth metals. Anomalous behaviour of Be.</td></tr>
</table>

	Chemistry of p- Block Elements (Group 13 & 14) preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates.
	UNIT-III
	Chemistry of p- Block Elements (Group 15-18) General characteristics of elementsof Group 15; chemistry of $H_2N\text{-}NH_2$, 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 group16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids).
	Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids ($HClO_4$). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens [$(CN)_2$ and $(SCN)_2$] 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.

	UNIT-IV **Hydrocarbon Chemistry-I** **Petroproducts:** Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses
	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; polymerization.
	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 – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene.

	Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation.
	Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes.
	UNIT-V **Hydrocarbon Chemistry - II** **Benzene:** Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity. **Polynuclear Aromatic hydrocarbons**: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at - position – reduction, oxidation – uses. Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.
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	• Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded, S.Chand and Company, New Delhi. • Sathya Prakash, Tuli G D,Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi. • Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi. • Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi. • Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar.
Reference Books	• Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4thed., The Macmillan Company, Newyork. • Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, NewDelhi. • Lee J D, (1991), Concise Inorganic Chemistry, 4thed., ELBS WilliamHeinemann, London. • Huheey J E, (1993), Inorganic Chemistry: Principles of Structure andReactivity, 4th ed., Addison Wesley Publishing Company, India. • Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed.,Goel Publishing House, Meerut. • Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry,8thed., Goel Publishing House,Meerut.
Website and e-learning source	https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding **MOOC components** http://nptel.ac.in/courses/104101090/ Lecture 1: Classification of elements and periodic properties http://nptel.ac.in/courses/104101090/

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 pblock elements, preparation and properties of aliphatic and aromatic hydrocarbons

CO2: discuss the periodic properties of sand p- block elements, reactions of aliphatic andaromatic 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 compoundsof 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

Title of the Course	**QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS**						
Paper No. Category	**Core Practical - CP 2**						
	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 • 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 • 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** • Nitration - picric acid from Phenol • Halogenation - p-bromo acetanilide from acetanilide • Oxidation - benzoic acid from Benzaldehyde • Microwave assisted reactions in water: • Methyl benzoate to Benzoic acid • Salicylic acid from Methyl Salicylate • Rearrangement - Benzil to Benzilic Acid • Hydrolysis of benzamide to Benzoic Acid

	Separation and Purification Techniques (Not for Examination) • Purificationof organic compounds by crystallization (from water / alcohol)and distillation • Determination of melting and boiling points of organic compounds. • **Steam distillation** - Extraction of essential oil from citrus fruits/eucalyptusleaves. • **Chromatography (any one) (Group experiment)** • Separation of amino acids by Paper Chromatography • Thin Layer Chromatography - mixture of sugars / plant pigments /permanganate dichromate. • Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate. • **Electrophoresis –** Separation of amino acids and proteins. **(Demonstration)** • Isolation of casein from milk/Determination of saponification value of oil orfat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5& 6–not for ESE)
Reference Books	• Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. *Basic Principlesof Practical Chemistry*, 2nd ed.; Sultan Chand: New Delhi, 2012. • Manna, A.K. *Practical Organic Chemistry*, Books and Allied: India,2018. • Gurtu, J. N; Kapoor, R. *Advanced Experimental Chemistry (Organic)*,Sultan Chand: New Delhi, 1987. • Furniss,B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. *Vogel'sTextbook of Practical Organic Chemistry*, 5th 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

Level of Correlation between PSO's and CO's

Title of the Course	**DAIRY CHEMISTRY**						
Paper No.	**NME 2**						
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	This course aims at providing an overall view of the • 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.

UNIT V

Fermented and other Milk Products

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.

Recommended Text	• K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition,2006. • K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia PublishingHouse New Delhi, 1974. • Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, IndianCouncil of Agricultural Research, 1 st edition, 2008. • A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 stedition,2013. • Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers,2021.
Reference Books	• Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, NewYork, 2005. • F.P.Wond, Fundamentals of Dairy Chemistry,Springer,Singapore,2006. • Sukumar De, Outlines of Dairy Technology, Oxford University Press, NewDelhi, 1980. • P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry,Springer, Second edition, 2016. • 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	

Course Learning Outcomes (for Mapping with POs and PSOs)On

completion of the course the students should be able to

CO 1: understand about general composition of milk – constituents and its physical properties.

CO 2: acquire knowledge about pasteurization of Milk and various types of pasteurization -Bottle, Batch and HTST Ultra High Temperature Pasteurization.

CO 3: learn about Cream and Butter their composition and how to estimate fat in cream andGhee

CO 4: explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.

CO 5: have an idea about how to make milk powder and its drying process - types of dryingprocess

	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

Title of the Course	**COSMETICS AND PERSONAL CARE PRODUCTS**						
Paper No.	**SEC 1 (Discipline Specific)**						
Category	**SEC**	**Year Semester**	I I/ II	**Credits**	2	**Course Code**	
Instructional	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
hours per week	2	-	-			2	
Prerequisites	Higher secondary Chemistry						
Objectives of the course	This course aims at familiarizing the students with • 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 cometics – A consumer guide, Macmillan publication, London.
Reference Books	• Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed.,Chemical Publishers, London. • George Howard, (1987) Principles and practiceof perfumes and cosmetics, Stanley Therones, Chettenham
Website and e-learning source	• http://www.khake.com/page75.html • Net.foxsm/list/284

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** know about the composition of various cosmetic products
- **CO2** understand chemical aspects and applications of hair care and dental care and skincare 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

Title of the Course	**GENERAL CHEMISTRY -III**						
Paper No.	**Core Course - CC 3**						
Category	**Core**	**Year Semester**	II III	**Credits**	5	**Course Code**	
Instructional hours per week	**Lecture** 4	**Tutorial** 1	**Lab Practice** -			**Total** 5	
Prerequisites	General Chemistry – I and II						
Objectives of the course	This course aims to provide a comprehensive knowledge on • the physical properties of gases, liquids, solids and X-ray diffraction of solids. • fundamentals of nuclear chemistry and nuclear waste management. • applications of nuclear energy • basic chemistry of halo-organic compounds, phenol and other aromaticalcohols. • 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,
	centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg's equation
	Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; comparison of structure and properties of diamond and graphite;.numerical problems involving core concepts Defects in solids - stoichiometric and nonstoichiometric defects. **Liquid crystals** – classification and applications. **UNIT-III** **Nuclear Chemistry**

	Natural radioactivity - α, β and γ rays; half-life period; Fajan_Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; 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. Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out) Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures. .
	UNIT-IV
	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.
	Di, Tri & Tetra Halogen derivatives: Nomenclature, classification, preparation, properties and applications.
	Aromatic halogen compounds Nomenclature, preparation, properties and uses Mechanism of nucleophilic aromatic substitution – benzyne intermediate. **Aryl alkyl halides** Nomenclature, benzyl chloride – preparation – preparation properties and uses
	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.

	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. Resorcinol, quinol, picric acid – preparation, properties and uses. **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.
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	• B.R. Puri, L.R. Sharma, M.S. Pathania; *Principles of Physical Chemistry*,46th edition, Vishal Publishing, 2020. • B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*,Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009. • 4. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, SultanChand & amp; Sons, twentieth edition, 2006. • M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing,fourth reprint, 2003. • S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.

Reference Books	• T. W. Graham Solomons, *Organic Chemistry*, John Wiley & Sons, fifth edition, 1992. • A. Carey Francis, *Organic Chemistry*, Tata McGraw-Hill Education Pvt.,Ltd.,New Delhi, seventh edition, 2009. • I. L. Finar, *Organic Chemistry*, Wesley Longman Ltd, England, sixth edition, 1996.
	• P. L. Soni, and H. M.Chawla - *Text Book of Organic Chemistry*, New Delhi,Sultan Chand & Sons, twenty ninth edition, 2007. • J.D. Lee, *Concise Inorganic Chemistry*, 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 it's 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

Title of the Course	**QUALITATIVE INORGANIC ANALYSIS**					
Paper No.	**Core Practical - CP 3**					
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** • Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, iodide, nitrate • Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite. • Elimination of interfering acid radicals and Identifying the group of basic radicals • Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc,manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium • Analysis of a mixture - I to VIII 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

Title of the Course	**ENTREPRENEURIAL SKILLS IN CHEMISTRY**						
Paper No. **Category**	**SEC 2** **Skill**	**Year**	II	**Credits**	1	**Course**	

	Enhancement Course	**Semester**	III			**Code**	
Instructional	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
hours per week	-	-	1			1	
Prerequisites	General Chemistry						

Objectives of the course

The course aims at providing training to

- 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	• George S &Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai. • 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, 1st 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**						
Paper No.	**SEC 3 (Discipline specific)**						
Category	**Skill Enhancement Course**	**Year**	II	**Credits**	2	**Course Code**	
		Semester	III				
Instructional hours per week	**Lecture** 2	**Tutorial** -	**Lab Practice** -			**Total** 2	
Prerequisites	Fundamentals in chemistry						

Objectives of the course	This course aims to providing the students • 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	**Unit I** **Introduction**: History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties. **Toxicity of pesticides**: Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides. **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. Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur. **Unit II** **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. **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.
	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	• Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012. • Matolcsy G, Nádasy M, Andriska V. Pesticide chemistry. Elsevier; 1989. • J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press,1985. • R. Cremlyn: Pesticides, John Wiley.
Reference Books	• Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors PLtd; 1st Ed. (2010). • Nollet L.M., Rathore H.S., Handbook of pesticides: methods ofpesticide residues analysis. CRC press; 2016. • Ellerbrock R.H., Pesticide Residues: Significance, Management andAnalysis, 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

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-IV</td></tr>
<tr><td>Paper No.
Category</td><td colspan="7">Core Course - CC 4
Core | Year II | Credits 4 | Course Code
Semester IV</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture
4</td><td>Tutorial
-</td><td colspan="3">Lab Practice
-</td><td colspan="2">Total
4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry III</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide a comprehensive knowledge on
• thermodynamic concepts on chemical processes and appliedaspects.
• 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</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I

Thermodynamics I
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</td></tr>
<tr><td></td><td colspan="7">expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson effect- inversion temperature.</td></tr>
</table>

	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 Zeroth law of thermodynamics-Absolute Temperature scale.
	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 probability of disorderliness.
	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-applications.
	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 group metals.
	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 $LiAH_4$ Thioethers - nomenclature, structure, preparation, properties and uses.

	Aldehydes and Ketones
	Nomenclatue, 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 – Pondorf 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, Hunsdieckerreaction.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. Schottan-Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement. **Active methylene compounds:** Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate
	Halogen substituted acids – nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids
	Hydroxy acids – nomenclature; preparation from halo, amino, aldehydic and ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on α, β and γhydroxy acids.
Extended Professional	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved
Component (is a	(To be discussed during the Tutorial hours)
part of internal	
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	• B.R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co., thirty three edition, 1992. • K. L. Kapoor, *A Textbook of Physical chemistry*, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009. • P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & Sons, twentieth edition, 2006. • M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003. • S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
Reference Books	• Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*,4thed.; The Macmillan Company: Newyork,1972. • Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS William Heinemann: London,1991. • Gurudeep Raj, *Advanced Inorganic Chemistry*, 26thed.; Goel Publishing House: Meerut, 2001. • Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford University Press:New York, 2014. • Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity*, 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 acidsand 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

Title of the Course	**PHYSICAL CHEMISTRY PRACTICAL – I**

Paper No.	**Core Practical - CP 4**						
Category	**Core**	**Year Semester**	II IV	**Credits**	2	**Course Code**	
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 • the laboratory experiments in order to understand the conceptsof physical changes in chemistry • the rates of chemical reactions • colligative 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. **UNIT II** **Electrochemistry – Conductance measurements** 6. Determination of cell constant 7. Determination of molar conductance of strong electrolyte 8. Determination of dissociation constant of acetic acid **Colorimetry** 9. Determination of concentration of copper sulphate solution **UNIT III** **Colligative property**						

	10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent
	Adsorption 11. Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	• Sindhu, P.S.*Practicals in Physical Chemistry*, Macmillan India :New Delhi, 2005. • Khosla, B. D.Garg,V. C.; Gulati, A.; *Senior Practical PhysicalChemistry*, R.Chand : New Delhi, 2011. • Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New AgeInternational: 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 electrochemistry, kinetics for carrying out the practical work.

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

	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

Title of the Course	**INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**						
Paper No.							
Category	**SEC 4 (Discipline specific)**						
	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 • operation and troubleshooting of chemical instruments • fundamentals of analytical techniques and its application in the characterization of compounds • theory of chromatographic separation and						
	• theory of thermo / electro analytical techniques • stoichiometry and the related concentration terms						
Course Outline	**UNIT-I** **Qualitative and Quantitative Aspects of Analysis** S.I Units, Distinction between Mass and Weight. Moles, Millimoles,						
	Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations 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.						
	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.						
	UNIT III						

	UV-Visible and IR Spectroscopy Origin of spectra, interaction of radiation with matter, fundamental laws of spetroscopy and selection rules, validity of Beer-Lambert's law. **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.
	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. Electroanalytical methods: Chronoamperometry - principle,
	instrumentation and applications. Cyclic Voltammetry - principle. **UNIT V** **Separation and purification techniques**

	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 Rf value.
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	• 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. • R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007 • Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017). • R. Speyer, Thermal Analysis of Materials, CRC Press, 1993. • R.A. Day and A.L. Underwood, Quantitative Analysis, 6thedn., Prentice Hall of India Private Ltd., New Delhi, 1993
Reference Books	• D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5thedn., Saunders college publishing, Philadelphia, 1998. • Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011. • Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004. • Mikes, O. &Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London • 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	• http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf • http://eric.ed.gov/?id=EJ386287 • http://www.sjsu.edu/faculty/watkins/diamag.htm • 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. Category	**SEC 5 (Discipline Specific)**						
	Skill Enhancement 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 • 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.
	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 andother security measures for VVIP-composition of bullets and detecting powder burns.
	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.
	UNIT-IV **Tracks and Traces** Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints -residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.

	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.
Recommended Text	• SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011. • Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press, Taylor & Francis Group, 2019. • Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basic principles of Forensic chemistry, Humana Press, first edition, 2012. • Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad. • Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.
Reference Books	• Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition,2003 • Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014. • Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015. • Max M. Houck & Jay A. Segal, (2006) Fundamentals of ForensicScience, Elsevier Academic press. • Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) HenryLee's Crime Scene Book Elsevier Academic press.
Website and e-learning source	• http://www.library.ucsb.edu/ist/03-spring/internet.html • http://www.wonder howto.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 deadorganisms 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 bulletsand 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 identificationand 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 onhandling fire explodes.

	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

Title of the Course	**ORGANIC CHEMISTRY - I**						
Paper No.	**Core Course - CC 5**						
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	This course aims to provide an understanding of • 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	**UNIT I** **Stereochemistry** Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism:cis–trans, syn-anti isomerism, E/Z notations. **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. Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane. **UNIT II** **Chemistry of Nitrogen Compounds – I** **Nitroalkanes** Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism. **Aromatic nitro compounds** Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT.
	Amines: Aliphatic amines Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement.

	Physical properties, reactions – alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.
	UNIT III **Chemistry of Nitrogen Compounds – II** **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.
	Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds Diazomethane, Benzene diazonium chloride - preparations and synthetic applications.
	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 Dyes Industry, Food colour and additives **UNIT IV** **Heterocyclic compounds** Nomenclature and classification. General characteristics - aromatic character and reactivity. Five-membered heterocyclic compounds
	Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.
	Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction. Thiophene synthesis - from acetylene; reactions –reduction; oxidation;
	electrophilic substitution reactions.

	UNIT V **Six-membered heterocyclic compounds** Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses Condensed ring systems Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.
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.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009. 2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009. • ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi,S.Chand& CompanyPvt. Ltd., Multicolour edition, 2012. • P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry,Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007. 5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.
Reference Books	• R. T. Morrison and R. N. Boyd, Organic Chemistry, PearsonEducation, Asia, sixth edition, 2012. • T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons,eleventh edition, 2012.

	• A. Carey Francis, Organic Chemistry, Tata McGraw-Hill EducationPvt. Ltd., New Delhi, seventh edition,2009. • I. L. Finar, Organic Chemistry, Vol. (1& 2), England, WesleyLongman Ltd, sixth edition, 2006. • J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, FifthEdition, 2010.
Website and e-learning sources	• www.epgpathshala.nic.in • www.nptel.ac.in • http:/swayam.gov.in • 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

Level of Correlation between PSO's and CO's

Title of the Course	**INORGANIC CHEMISTRY -I**						
Paper No.	**Core Course - CC 6**						
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	The course aims to provide knowledge on • 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	**UNIT I** **Co-ordination Chemistry - I** IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds. Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory – geometry of co-ordination compounds with co-ordination number 4 &6. 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. Role of metal chelates in living systems – haemoglobin and chlorophyll						

	Unit II **Co-ordination Chemistry - II** 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 $[Ti(H_2O)_6]^{3+}$ - 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.

	UNIT III **Organometallic compounds** **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. Ferrocene-Methods of preparation, physical and chemical properties
	UNIT IV **Inner transition elements (Lanthanoids and Actinoids)** 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. **UNIT V** **Inorganic polymers** 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 polyphophonitrilic chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – industrial applications of inorganic polymers.

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	• Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31thEdition, Milestone Publishers & Distributors, Delhi. • Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi • Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBSWilliam Heinemann, London. • W V Malik, G D Tuli, R D Madan, (2000), Selected Topics inInorganic Chemistry, S. Chand and Company Ltd. • A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd,seventh edition, 1992.
Reference Books	• Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry,2nd ed ., S.Chand and Company, New Delhi. • Gopalan R, (2009) Inorganic Chemistry for Undergraduates, IstEdition, University Press (India) Private Limited,Hyderabad • Sivasankar B, (2013) Inorganic Chemistry.Ist Edition, Pearson, Chennai • Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition-Wesley, England • Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website and e-learning source	• www.epgpathshala.nic.in • www.nptel.ac.in • 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

Level of Correlation between PSO's and CO's

Title of the Course	**PHYSICAL CHEMISTRY -I**					
Paper No.	**Core Course - CC 7**					
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	The course aims at providing an overall view of • 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	**UNIT I** **Thermodynamics - III** 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. 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.

	UNIT II **Chemical Kinetics** **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. 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. Complex reactions – reversible and parallel reactions (no derivation and only examples) • kinetics of consecutive reactions – steady state approximation.

	UNIT III 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) 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
	UNIT IV **Colloids and Surface Chemistr**y **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, Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids

	Macromolecules: Molecular weight of Macromolecules-Number average molecular weight- average molecular weight, Determination of Molecular weight of molecules **UNIT V** **Photochemistry** Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H_2-Cl_2, H_2-Br_2 and H_2-I_2 reactions, comparison between thermal and photochemical reactions. 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

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	• B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021. • Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018. • ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co. • S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. • J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.
Reference Books	• J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013. • Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003. • P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. • 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. Jalendhar, forty first, edition, 2001
Website and e-learning source	• https://nptel.ac.in • https://swayam.gov.in • 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 Ellinghams

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 homogenous 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

Title of the Course	**INDUSTRIAL CHEMISTRY**					
Paper No.	**EC VI**					
Category	**Elective**	**Year Semester**	III V	**Credits**	3	**Course Code**
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**
	4	-	-			4

Prerequisites	General Chemistry I,II, III and IV
Objectives of the course	This course is designed to provide knowledge on • 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	**UNIT I** **Survey of Indian Industries and mineral resources in India**
	Fuels: Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal- proximate analysis and ultimate analysis; calorific value-determination, carbonisation of coal.
	Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol-knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number. Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas - preparations - uses.
	Natural gas: LPG-composition, advantages, application; gobar gas-production, composition, advantages, application. Propellants – rocket fuels (basic idea)
	UNIT II **Cosmetics**
	Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations. Dental care: tooth pastes – ingredients. Hair care: shampoos-types, ingredients; conditioners-types, ingredients. Perfumes: natural-plant origin-parts of the plant used, chief constituents;

animal origin-amber gries, civetone and musk; synthetic-classification-esters-amylsalicylate alcohols-citronellol; terpeneols-gereniol and nerol; ketones-muskone, coumarin; aldehydes-vanilin.

Soaps and Detergents

Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap – ingredients.

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.

UNIT III
Sugar Industry

Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar.

Food Preservation and processing

Food spoilage – causes; Food preservation - methods – high temperature, low temperature, drying, radiation; Food additives – preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius.

UNIT IV
Abrasives

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.

Leather Industry

Structure and composition of skin, hide; Manufacture of leather – pre-tanning process – curing, liming, beating, pickling; methods of tanning-vegetable, chrome – one bath, two bath process; finishing.

Paper Industry

Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.

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,

	selection of lubricants. **Cement Industry** Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete. **Intellectual Property Rights** Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks
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	• Sharma, B.K. *Industrial Chemistry*, 9th ed.; Goel Publishing House: Meerut, 1998. • Wilkinson, J.B.E. Moore, R.J. *Harry's Cosmeticology*, 7th ed.; Chemical Publishers : New York, 1982. • Alex V. Ramani, *Food Chemistry*, MJP publishers: Chennai, 2009. • Jayashree Ghosh, *Applied Chemsitry*, S. Chand : New Delhi, 2006. • Srilakshmi, B. *Food Science*, 4th ed.; New Age International Publication, 2005.

Reference Books	• Jain, P.C.; Jain, M. *Engineering Chemistry*, 16th ed.; Dhanapet Rai: Delhi, 1992 • George Howard, *Principles and Practice of Perfumes and Cosmetics*, Stanley Therones, Cheltenham: UK, 1987. • Thankamma Jacob, *Foods, Drugs and Cosmetics - A ConsumerGuide*, Macmillan : London, 1997. • ShankuntalaManay, N.; Shadaksharaswamy, M. *Food Facts and Principles*, 3rd ed.; New Age Publication, 2008. • Neeraj Pandey, KhushdeepDharni, *Intellectual Property Rights*, PHI Learning, 2014.

Website and e-learning source	• http://www.sciencecases.org/irradiation/irradiation_notes.asp • http://discovery.kcpc.usyd.edu.au//9.5.5/ • 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

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 course	The course aims at providing knowledge on • 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	**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.						
	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.						
	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.						
	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.						

	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. Metabolism of lipids: β-oxidation of fatty acids.
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	• Bahl, B. S.; Bhal, A. *Advanced Organic Chemistry*, 3rd ed.; S. Chand: New Delhi, 2003. • Jain, M.K.; Sharma, S.C. *Modern Organic Chemistry*, VishalPublications: New Delhi, 2017. • Shanmugam, A. *Fundamentals of Biochemistry for Medical Students*,6th ed.; Published by the author, 1999. • Veerakumari, L. *Biochemistry*, 1st ed.; MJP Publications: Chennai, 2004. • Jain, J. L.; *Fundamentals of Biochemistry*, 2nd ed.; S.Chand: New Delhi, 1983.
Reference Books	• Conn, E. E.; Stumpf, P. K. *Outline of Biochemistry*, 5th ed.; WileyEastern: New Delhi, 2002. • West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. *Text Bookof Biochemistry*, 4th ed.; Macmillan: New York, 1970. • Lehninger, A. L. *Principles of Biochemistry*, 2nd ed.; CBS Publisher: Delhi, 1993. • Rastogi, S. C. *Biochemistry*, 2nd ed.; Tata McGraw-Hill: New Delhi, 2003. 5. Chatterjea, M. N.; Shinde, R. *Textbook of Medical Biochemistry*, 5th ed.; Jaypee Brothers: New Delhi, 2002.
Website and e-learning source	1) http://library.med.utah.edu/NetBiochem/nucacids.html 2)http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html • https://swayam.gov.in/courses/4384-biochemistry Biochemistry • https://onlinecourses.nptel.ac.in/noc19_cy07/previewExperimental 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

<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANIC CHEMISTRY - II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course - CC 8</td></tr>
<tr><td>Category</td><td>Core</td><td>Year Semester</td><td>III
VI</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>1</td><td>4</td><td colspan="2">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Organic Chemistry – I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• 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</td></tr>
<tr><td>Course Outline</td><td colspan="7">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.</td></tr>
</table>

	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, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement **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 **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.

Extended	Questions related to the above topics, from various competitive
Professional Component (is a	examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
part of internal 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	• M.K.Jain, S. C.Sharma, Modern Organic Chemistry, VishalPublishing, 4th reprint,2009. • S.M. Mukherji, and S.P. Singh, Reaction Mechanism in OrganicChemistry, Macmillan IndiaLtd., 3rd edition,2009 • Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition,2012. • P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry,Sultan Chand & Sons, New Delhi, 29th edition, 2007.

	5. C Bandyopadhya; An Insight into Green Chemistry; Published on 2020
Reference Books	• R. T. Morrison and R. N. Boyd, Organic Chemistry, PearsonEducation, Asia,6th edition, 2012. • T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons,11th edition, 2012. • A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi,7th edition,2009. • I. L. Finar, Organic Chemistry, Vol. (1& 2), England, WesleyLongman Ltd, 6th edition, 2006. • J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5thEdition, 2010.

Website and e-learning source	1.www.epgpathshala.nic.in 2.www.nptel.ac.in 3.http:/swayam.gov.in • Virtual Textbook of Organic Chemistry • 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 disachharides
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

Title of the Course	**INORGANIC CHEMISTRY –II**

Paper No.	**Core Course - CC 9**						
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	The course aims to provide knowledge on • 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** Introduction – general properties of silicates, structure – types of silicates – ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates(pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines) **UNIT V** **Industrial Applications of Inorganic Compounds** Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti-skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels. Nanocomposite Hydrogels: synthesis, characterization and uses. Industrial visits and internship mandatory.
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. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th ed., Milestone Publishers & Distributors, Delhi.

	• Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advancd Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi • Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS WilliamHeinemann, London. • W V Malik, G D Tuli, R D Madan, (2000), Selected Topics inInorganic Chemistry, Schand and Company Ltd. • A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventhedition, 1992

Reference Books	• Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry,2nded., S.Chand and Company, New Delhi. • Gopalan R, (2009) Inorganic Chemistry for Undergraduates, IstEdition, University Press (India) Private Limited, Hyderabad • Sivasankar B, (2013) Inorganic Chemistry. Ist Edition, Pearson, Chennai • Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition-Wesley, England • Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website and e-learning source	• www.epgpathshala.nic.in • www.nptel.ac.in • 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 B_{12}, 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

Title of the Course	**PHYSICAL CHEMISTRY-II**						
Paper No.	**Core Course - CC 10**						
Category	**Core**	**Year Semester**	III VI	**Credits**	3	**Course Code**	
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	4	1	-			5	
Prerequisites	Physical Chemistry - I						
Objectives of the course	The course aims at providing an overall view of the • 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 electrochemicalseries.						
Course Outline	**UNIT-I** **Phase rule** 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						

	change (sodium – potassium), solid solution (gold-silver); copper sulphate – water system.
	UNIT II **Chemical equilibrium** 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

	UNIT III **Binary liquid mixtures** 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.
	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.
	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

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

Reference Books	• K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition,2009. • Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985. • P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. • B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001 • 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

Title of the Course	**FUNDAMENTALS OF SPECTROSCOPY**						
Paper No.	**EC VII**						
Category	**Elective Course**	**Year Semester**	III VI	**Credits**	3	**Course Code**	
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	4	1	-			5	
Prerequisites	General Chemistry I,II,III and IV						
Objectives of the course	This course is designed to provide knowledge on • 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	**UNIT I** **Electrical and Magnetic properties of molecules** Dipole moment – polar and nonpolar molecules – polarisability of molecules. Application of dipole moments in the study of organic and inorganic molecules. Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti ferromagnetism **Microwave spectroscopy** Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications **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 - σ -σ *, π-
	π*, n-σ*, n-π* 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+})
	UNIT III
	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)
	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. **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.
	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	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved
Component (is a	(To be discussed during the Tutorial hours)
part of internal 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	• Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. *Elements ofAnalytical Chemistry*; S Chand: New Delhi, 2003. • Usharani, S. *Analytical Chemistry*, 1st ed.; Macmillan: India, 2002. • Banwell, C.N.; Mc Cash, E. M. *Fundamentals of MolecularSpectroscopy*, 4th ed.; Tata McGraw Hill, New Delhi, 2017. • U.N.Dash, Analytical Chemistry Theory and Practice, Sultan Chand&Sons,2nd Ed., 2005 • B.K.Sharma, Spectroscopy,22nd ed., Goel Publishing House, 2011.

Reference Books	• Srivastava, A. K.; Jain, P. C. *Chemical Analysis an Instrumental Approach*, 3rded.; S.Chand, New Delhi, 1997. • Robert D Braun. *Introduction to Instrumental Analysis*; Mc.Graw Hill: New York, 1987. • Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. *Fundamentals of Analytical Chemistry*, 9thed.; Harcourt college Publishers: USA, 2013. • Madan, R. L.; Tuli, G. D. *Physical Chemistry*, 2nded.; S.Chand: New Delhi, 2005. • Puri, B. R.; Sharma, L. R.; Pathania, M.S. *Principles of Physical Chemistry*, 43rd 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 • www.epgpathshala.nic.in • 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: 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

	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	**PHYSICAL CHEMISTRY PRACTICAL – II**						
Paper No.	**Core Practical - CP 5**						
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 • basic principles of physical chemistry experiments • hands on experience in carrying out the experiments						
Course Outline	**UNIT I** **Phase diagrams** • Simple eutectic - determination of eutectic temperature and composition of naphthalene-diphenyl amine or naphthalene-diphenyl system • Determination of transition temperature of a salt hydrate. • Determination of upper critical solution temperature of phenol – water system • Effect of an electrolyte on miscibility temperature of phenol – watersystem • Determination of concentration of sodium chloride using phenol-sodium chloride system						
	Unit II						
	Distribution law • Determination of the distribution coefficient of iodine betweencarbon tetrachloride and water. • Determination of equilibrium constant of the reaction $I_2 + I \rightleftharpoons I_3$ 8. Determination of concentration of the given potassium iodide solution using the above equilibrium constant. **UNIT III** **Electrochemistry** • Conductometric titration of hydrochloric acid against sodium hydroxide • Potentiometric titration of ferrous ion against potassium dichromate using quinhydronde electrode.						

Extended	Questions related to the above topics, from various competitive
Professional Component (is a part of internal component only,	examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
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.
Reference Books	• Sindhu, P.S. *Practicals in Physical Chemistry*, Macmillan India :New Delhi, 2005. • Khosla, B. D. Garg,V. C.; Gulati, A. *Senior Practical PhysicalChemistry*, R. Chand : New Delhi, 2011. • Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New AgeInternational : 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

Title of the Course	**NANOSCIENCE**						
Paper No.	**E C VIII**						
Category	**Elective**	**Year**	III	**Credits**	3	**Course**	
		Semester	VI			**Code**	
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	4		-			4	
Prerequisites	Basics knowledge in physics and chemistry						
Objectives of the course	This course aims at providing knowledge on • introduction to nanoparticles/clusters and nanocomposites • properties of nanomaterials • characterization of nanomaterials by different methods • synthesis of carbon nanotubes, graphene, quantum dots, self-assembled nanomaterials • applications of nanomaterials as sensors						

Course Outline	**UNIT I** **Introduction to nanoscience** Definition of terms – nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials. Synthesis and stabilization of nanomaterialsTop down approach (physical methods), mechanical dispersion – ball milling, methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis-nanolithography. Bottom–up approach (chemical methods) - solvothermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes- solvents reducing agents, capping agents-stabilization of nanoparticles -electrostatic and steric
	stabilization, common stabilizers, nanoparticle growth in solution, templated growth, Langmuir – Blodgett (L-B) method, reverse micelles-emulsion method. **Unit II**
	Properties of materials on a nanoscale Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe_3O_4 particle, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties. **UNIT III**

	Techniques employed for characterisation of nanomaterials
	Spectrocopy – UV-visible, Photoelectron spectroscopy – Electron
	microscopy – Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) –
	Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy
	(STM), Optical microscopy – confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only].
	UNIT IV **Special nanomaterials**
	Carbon Nano Structures Carbon nanotubes: Introduction - types - zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission, Fuel Cells,
	Display devices . Other Important Carbon based materials: Preparation and Characterization Fullerene, Graphene, properties, DLC and
	nanodiamonds and Applications Semiconductor nanoparticles: Quantum dots, synthesis – chemical synthesis using clusters, properties, porous silicon – electrochemical
	etching, aerogel – types – silica aerogel, resorcinol formaldehyde (RF) aerogels, zeolites – applications. Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS) –
	inorganic, organic molecules.
	UNIT V **Application of nanomaterials**
	Biomedical Applications- drug, drug delivery, biolabelling, artificial
	implants, cancer treatment. Sensors – Natural nanoscale sensors, chemical sensors, biosensors, electronic noses.
	Optics & Electronics – Nanomaterials in the next generation computer
	technology, high definition TV, flat panel displays, quantum dot laser, single electron transistors [SET].
	Nanotechnology in agriculture – Fertilizer and pesticides nanomaterials
	for water purification, nanomaterials in food and packaging materials, fabric industry.
	Impacts of Nanotechnology – human & environmental safety risks.
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	• Sulabha K. Kulkarni, *Nanotechnology: Principles and Practices*, Capital Publishing Co., New Delhi. • Pradeep. T, *Nano: The Essentials, Understanding Nanoscience and Nanotechnology*; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007. • Shah. M.A.; Tokeer Ahmad, *Principles of Nanoscince and Nanotechnology*; Narosa Publishing House, New Delhi, 2010. • Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. JamesMurday, *Textbook of Nanoscience and Nanotechnology*;Universities press, India Ltd ,Hyderabad. 2012.
Reference Books	• Sharma. P.K., *Understanding Nanotechnology*; Vista International Publishing House, Delhi. 2008. • Charles P. Poole Jr.; Frank J. Owens. *Introduction to Nanotechnology;* A John Wiley & Sons, INC., Publication, 2003. • Viswanathan B., *Nano Materials;*Narosa Publishing House, NewDelhi, 2009. • Edited by C.N.R. Rao; Mu¨ller.A; Cheetham. A.K.*Nanomaterials Chemistry Recent Developments and New Directions*, WILEY-VCH Verlag GMBH & Co.,KGaA, Darmstad. • Jing Zhong Zhang, *Optical properties and spectroscopy of Nanomaterials*; World Scientific Publishing Pvt. Ltd., Singapore.
Website and e-learning source	• http://www.nanotechnology.com/docs/wtd015798.pdf • http://nccr.iitm.ac.in/Nanomaterials.pdf

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

CO1: explain the general concepts and physical phenomena of relevance within the field of nanoscience.

CO2: describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.

CO3: examine the structure, properties, applicability and characterization of nanomaterials.

CO4:analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene

CO5: discuss applications of nanomaterials of sensors and in optics and electronics

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	**POLYMER SCIENCE**						
Paper No. Category	**EC VIII Elective**	**Year Semester**	III VI	**Credits**	3	**Course Code**	
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	4		-			4	
Prerequisites	Knowledge on functional groups and reaction mechanisms						
Objectives of the course	The course aims at providing an overall view of • classification of polymers, preparation of polymers • kinetics of polymerization and characterization of polymers • analytical techniques used to characterize polymers • reactions of polymers • speciality polymers like PVC, PMMA						
Course Outline	**UNIT I** **Introduction** Difference between polymer and macromolecule – classification – synthetic and natural, organic and inorganic, thermoplastic and						

	thermosetting. Plastics, elastomers, fibres and liquid resins.
	Techniques of polymerization Bulk, solution, emulsion and suspension polymerization **Unit – II**
	Kinetics of polymerization Kinetics of condensation and addition polymerisation; ionic, free radical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers. **Characterisation of polymers**

	Appearance, feel and hardness, density, effect of heat, solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state.
	UNIT III **Molecular Weight and Properties of Polymers** Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry – gel permeation chromatography Thermal properties of polymers – Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature, Importance of
	Glass Transition Temperature, Heat Distortion Temperature, TGA / DTA,Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity
	UNIT IV Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer
	Polymer technology Processing of polymers – casting, thermoforming, moulding –
	extrusion, compression, blow moulding – foaming, lamination, reinforcing – processing of fibres – melt, wet and dry spinning.
	UNIT V **Speciality polymers** Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical polymers, liquid crystalline polymers, electroluminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanisation of rubber. **Polymer Degradation** Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo

	Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.

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	• Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer Science. • New Delhi: New Age International, 2015 • Misra G.S. Introductory Polymer Chemistry. New Delhi: WileyEastern, 2010. • Bahadur P and Sastry N V. Principles of Polymer Science. New Delhi: Narosa Publishing House, 2005 • Ahluwalia, V.K. Anuradha Mishra, *Polymer Science A Text Book*, Ane Books India: New Delhi, 2008. • Morrison, R. R.; Boyd, R. N.; Bhattacharjee, S. K. *OrganicChemistry*, 7th ed.; Pearson: New Delhi, 2011.
Reference Books	• Billmeyer, F.W. Polymer Science. India: Wiley-Interscience, 2007. • Seymour, R. B.; CarraherJr.C.E. *Polymer Chemistry: An Introduction*, Marcel Dckker Inc : New York, 1981. • Sinha, R. *Outlines of Polymer Technology*, Prentice Hall of India:New Delhi, 2000. • Joel R. Fried, *Polymer Science and Technology*, 3rd ed.; Prentice Hall of India: New Delhi, 2014.
Website and e-learning source	• https://polymerdatabase.com • http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1 3.http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.htm 4.http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weights+of+polymers.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to
CO1: explain classification of polymers, elastomers, fibres and liquid resins
CO2: explain addition and condensation polymerization, mechanical properties of polymers
CO3: determine the molecular weight of polymers, and explain the thermal properties of polymers
CO4:explain reactions of polymers and polymer processing

CO5:discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers

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	**PHARMACEUTICAL CHEMISTRY**					
Paper No.	**Elective Course VIII**					
Category	**Elective**	**Year**	III	**Credits**	3	**Course Code**
		Semester	VI			
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**
	4		-			4
Prerequisites	Knowledge on active chemical compounds and biochemistry					
Objectives of the course	The course aims at providing an overall view of • drugs design and drug metabolism • important Indian medicinal plants, common diseases and antibiotics					

Course Outline	• drugs for major diseases like cancer, diabetes and AIDS • analgesics and antipyretic agents • significance of clinical tests **UNIT I** **Introduction** Important terminologies – drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index.
	Sources of drugs – dosage forms – bio availability – routes of administration – absorption, distribution and elimination of drugs – drug metabolism – prescription terms. **Structure and pharmacological activity** Effect of – unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups.
	Development of Drugs Development of a drug – classic steps- lead compounds- comparison of traditional and modern methods of development of drugs – drug design by method of variation – disjunction and conjunction methods.
	Unit II **Indian medicinal plants** Some important Indian medicinal plants – tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai – uses. **Common diseases and their treatment** Causes, prevention and treatment of the following diseases: Insect borne diseases– malaria, filariasis, plague;Air borne diseases– diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases – cholera, typhoid , dysentery. Digestive system – jaundice; Respiratory system – asthma; Nervous system – epilepsy.
	Antibiotics Definition – classification – structure and therapeutic uses of chloramphenicol, penicillins , structure activity relationship of chloramphenicol ; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.

	UNIT III **Drugs for major diseases** Cancer – common causes – chemotherapy – anti neoplastic agents - classification –adverse effects of cytotoxic agents ; alkylating agents – chlorambucil ; anti metabolites – methotrexate, fluouracil ; Vinca alkaloids – vincristine, vinblastine.Diabetes– types –

	management of diabetes – insulin ; oral hypoglycemic agents - sulphonyl ureas – chlorpropamide ; biguanides - metformin – thiazolidinediones .Cardiovascular drugs– cardio glycosides ; anti arrhythmic agents – quinidine, propranolol hydrochloride ; anti-hypertensive drugs - Aldomet, pentoliniumtartarate; vasodilator-tolazoline hydrochloride, sodium nitroprusside.AIDS – causes, symptoms and prevention – anti HIV drugs - AZT, DDC. **UNIT IV** **Analgesics and antipyretic agents** Classification – action of analgesics – narcotic analgesics –morphine; synthetic analgesics – pethidine, methadone; antipyretic analgesics – salicylic acid derivatives, indolyl derivatives, p-aminophenol derivatives. **Anaesthetics** Definition, characteristics, classification - general anaesthetics – volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene– storage, advantages and disadvantages ; non volatileanaesthetics – thiopental sodium ; local anaesthetics – requisites – advantages- esters – cocaine, benzocaine ; amides – lignocaine, cinchocaine. **Blood and haemotological agents** Blood– composition, grouping – physiological functions of plasma proteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, dry thrombin; Anti coagulants – coumarins, citric acid and heparin; antifibrinolytic agents – aminocaproic acid and tranexamic acid. Anaemia– causes, types and control – anti anaemic drugs.
	UNIT V **Clinical Chemistry** Blood tests – blood count – complete haemotogram – Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time –- glucose tolerance test.
	Significance of Clinical Tests Serum electrolytes - blood Glucose - orthotoluidine method**;** Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile – cholesterol, triglycerides, HDL, LDL, coronary risk index. Urine examination – pH, tests for glucose, albumin and bile pigment.
Extended	Questions related to the above topics, from various competitive

Professional	examinations UPSC/ JAM /TNPSC others to be solved
Component (is a part of internal	(To be discussed during the Tutorial hours)
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	• Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S.Chand& company, New Delhi. • Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultan chand& sons, Delhi. • Tripathi K D, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi. • Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New age international (P) Limited, Publishers, New Delhi.
Reference Books	**Reference Books:** • Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6thed ., Himalaya publishing house, Bombay. • Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II)., Himalaya publishing house, Bombay. • Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi. • Intellectual Property Rights, NeerajPandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896.
Website and e-learning source	• http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar5 31_delete/lectures/qsar_1.pdf • http://www.indianmedicinalplants.info/ • https://www.wipo.int/about-ip/en/

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

CO1: Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.

CO2: Discuss the development of drugs, structural activity, disease types, physio-chemical properties of therapeutic agents, significance of medicinal plants,clinical tests and factors for patentability.

CO3: Apply the principles involved in structural activity and drug designing, functions ofhaematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.

CO4: explain classification of analgesics and anasthetics, and physiological functions of plasma protiens

CO5: explain the significance of clinical tests like blood urea, serum proteins and coronary risk index

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

GENERIC ELECTIVE

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 Objectives of the course	Higher secondary chemistry This course aims to provide knowledge on the • basics of atomic orbitals, chemical bonds, hybridization • concepts of thermodynamics and its applications. • concepts of nuclear chemistry • importance of chemical industries • Qualitative and analytical methods.						
Course Outline	**UNIT I** **Chemical Bonding and Nuclear Chemistry** Chemical Bonding**:** Molecular Orbital Theory-bonding, antibonding						

and non-bonding orbitals. Molecular orbital diagrams for Hydrogen,
Helium, Nitrogen; discussion of bond order and magnetic properties.
Nuclear Chemistry: Fundamental particles - Isotopes, Isobars,
Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications. **Unit II**
Industrial Chemistry Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones**:** Synthesis, properties and uses of
silicones.
Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.

	UNIT III **Fundamental Concepts in Organic Chemistry** Hybridization: Orbital overlap, hybridization and geometry of CH4, C2H4, C2H2 and C6H6. Electronic effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples. Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine. **UNIT IV**
	Thermodynamics and Phase Equilibria Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy.
	Phase Equilibria**:** Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).
	UNIT V **Analytical Chemistry** Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.
Extended Professional Component (is a part of internal	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

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	• V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. • S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. • S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, NewDelhi, twenty third edition, 2012. • P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninthedition, 2007.
Reference Books	• P.L.Soni,MohanKatyal,TextbookofInorganicchemistry;SultanChandandCompany,New Delhi, twentieth edition, 2007. • B.R.Puri,L.R.Sharma,M.S.Pathania,TextbookPhysicalChemistry;VishalPublishingCo., New Delhi, fortyfortyseventh edition, 2018. • B.K,Sharma,IndustrialChemistry;GOELpublishinghouse,Meerut,sixteenthedition, 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 reactionsand 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 theorganic reactions.
CO 4: apply various thermodynamic principles, systems and phase rule.
CO 5: explain various methods to identify an appropriate method for the separation ofchemical 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

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** 4	**Tutorial** -	**Lab Practice** -		**Total** 4		

Prerequisites	Chemistry for physical sciences -I
Objectives of the course	This course aims at providing knowledge on the • 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	**UNIT I** **Co-ordination Chemistry and Water Technology** Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)4]$, $[Ni(CN)4]^{2-}$,$[Co(CN)6]^{3-}$ Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques-BOD, COD.

Unit II
Carbohydrates and Amino acids

Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose –fructose interconversion. Properties of starch and cellulose.

Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).

UNIT III
Electrochemistry

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

UNIT IV
Kinetics and Catalysis

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

UNIT V
Photochemistry

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

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	• V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. • S.Vaithyanathan, Text book of Ancillary Chemistry; PriyaPublications, Karur,2006. • Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand andCompany, New Delhi, twenty third edition, 2012. • P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; SultanChand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	• P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; SultanChand and Company, New Delhi, twentieth edition, 2007. • R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry;Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
Website and e-learning source	3. 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, 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

<table>
<tr><td>Title of the Course

Paper No.</td><td colspan="6">CHEMISTRY FOR BIOLOGICAL SCIENCES I(FOR BOTANY AND ZOOLOGY STUDENTS)
Generic Elective III</td></tr>
<tr><td>Category

Instructional hours per week
Prerequisites</td><td colspan="6">Generic Elective | Year II | Credits 3 | Course Code
Semester III
Lecture 4 | Tutorial - | Lab Practice - | Total 4
Higher seccondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="6">This course aims at providing knowledge on
• 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.</td></tr>
</table>

Course Outline	**UNIT I** **Chemical Bonding and Nuclear Chemistry** Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications. **Unit II** **Industrial Chemistry** Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.
	UNIT III **Fundamental Concepts in Organic Chemistry** Hybridization: Orbital overlap hybridization and geometry of CH4, C2H4, C2H2 and C6H6. Polar effects: Inductive effect and consequences on Ka and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.
	UNIT IV **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.
Extended Professional	**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. Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved
Component (is a part of internal	(To be discussed during the Tutorial hours)
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	• V.Veeraiyan, Textbook of Ancillary Chemistry; High mountpublishing house, Chennai, first edition,2009. • S.Vaithyanathan, Text book of Ancillary Chemistry; PriyaPublications, Karur,2006. • ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chandand Company, New Delhi, twenty third edition,2012. • P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Books	• P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. • B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. • 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

Title of the Course	CHEMISTRY FOR BIOLOGICAL SCIENCES II (FOR BOTANY AND ZOOLOGY STUDENTS)						
Paper No. Category	Generic Elective IV						
	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 • 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'stheory - EAN rule - Pauling's theory – Postulates - Applications to [Ni(CO)4], $[Ni(CN)4]^{2-}$,$[Co(CN)6]^{3-}$ 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.
	UNIT III **Amino Acids and Essential elements of biosystem** Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins-classification – structure - Colour reactions – Biological functions – nucleosides -nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.

	UNIT IV **Electrochemistry** Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention. **UNIT V** **Photochemistry** 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).
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	• V.Veeraiyan, Textbook of Ancillary Chemistry; High mountpublishing house, Chennai, first edition, 2009. • S.Vaithyanathan, Text book of Ancillary Chemistry; PriyaPublications, Karur, 2006. • Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chandand Company, New Delhi, twenty third edition, 2012. • P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; SultanChand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	• Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. • P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007. • P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry;

	Sultan Chand and Company, New Delhi, twentieth edition, 2007. • B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. • 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

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 Semester**	I/ II I/III	**Credits**	1	**Course Code**
Instructional hours per week	**Lecture** -	**Tutorial** -	**Lab Practice** 2			**Total** 2
Prerequisites						
Objectives of the course	This course aims to provide knowledge on the • basics of preparation of solutions. • principles and practical experience of volumetric analysis					
Course Outline	**VOLUMETRIC ANALYSIS** • Estimation of sodium hydroxide using standard sodiumcarbonate. • Estimation of hydrochloric acid using standard oxalic acid. • Estimation of ferrous sulphate using standard Mohr's salt. • Estimation of oxalic acid using standard ferrous sulphate. • Estimation of potassium permanganate using standard sodium hydroxide. • Estimation of magnesium using EDTA. • Estimation of ferrous ion using diphenyl amine as indicator.					
Reference Books	V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles ofPractical 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

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES
(For Mathematics and Physics – I year/II semester;
For Botany and Zoology II year/IV semester)</td></tr>
<tr><td>Paper No.
Category</td><td colspan="7">Generic Elective VI
<table><tr><td rowspan="2">Generic Elective</td><td>Year</td><td>I/ II</td><td>Credits</td><td>1</td><td>Course Code</td><td></td></tr><tr><td>Semester</td><td>II/IV</td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Instructional hours per week
Prerequisites</td><td>Lecture
-</td><td>Tutorial
-</td><td colspan="3">Lab Practice
2</td><td>Total
2</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
• identification of organic functional groups
• different types of organic compounds with respect to theirproperties.
• determination of elements in organic compounds..
SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS
The analysis must be carried out as follows:</td></tr>
</table>

	• Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose]. • Detection of elements (N, S, Halogens). • To distinguish between aliphatic and aromatic compounds. • To distinguish – Saturated and unsaturated compounds.
Reference Books	V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles ofPractical 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

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 skillsin organic, inorganic and physical chemistry.

PSO3: uphold ethical values in personal life, research and career.

PSO4: demonstrate laboratory skills, analytical acumen, creatively in academics andresearch.

PSO5: apply digital tools to collect, analyze and interpret data and presents cientificfindings.

PSO6: gain competence to pursue higher education and career opportunities inchemistry and allied fields.

PSO7: exhibit leadership qualities to work individually and within a team inorganizing 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 thatcontribute towards the holistic development of self and community.

PSO10: display proactive approach towards sustainable environment through greenlaboratory practices.

PO-PSO MAPPING MATRIX:

PSOs / **POs**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**

PO1	**X**									
PO2		**X**								
PO3			**X**							
PO4				**X**						
PO5					**X**					
PO6						**X**				
PO7							**X**			
PO8								**X**		
PO9									**X**	
PO10										**X**