

RAJAH SERFOJI GOVERNMENT COLLEGE (Autonomous)
[Affiliated to Bharathidasan University]
(NAAC 'A' Grade and DST-FIST Institution)
THANJAVUR – 613005



PG & RESEARCH DEPARTMENT OF CHEMISTRY

CURRICULUM AND SYLLABUS

FOR

B.Sc. Degree Programme in Chemistry

Semester Pattern (Three-Year Degree Programme)

CHOICE BASED CREDIT SYSTEM -
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK
(CBCS - LOCF)

Effective from the Academic Year 2026-2027

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	B.Sc. Chemistry
Programme Code:	
Duration:	3 Years (UG)
Programme Outcomes:	PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study PO2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. PO3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. PO4: Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. PO5: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. PO6: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation PO7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team

Programme Specific Outcomes:	PO8: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. PO9: Reflective thinking: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society. PO10 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. PO 11: Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. PO 12: Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. PO 13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. PO 15: Lifelong learning: Ability to acquire knowledge and skills, including „learning how to learn“, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
	On successful completion of Bachelor of Physics with Computer Applications programme, the student should be able to: PSO1: Disciplinary Knowledge: Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory. PSO2: Critical Thinking: Analyze complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively PSO3: Problem Solving: Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities. PSO4: Analytical & Scientific Reasoning: Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.

	PSO5: Research related skills: Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.
	PSO6: Self-directed & Lifelong Learning: Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.

RAJAH SERFOJI GOVT COLLEGE (AUTONOMOUS), THANJAVUR-5								
COURSE STRUCTURE FOR UNDERGRADUATE SCIENCE								
(Applicable to the Candidates admitted from the academic year 2026-2027 onwards)								
B.Sc., CHEMISTRY								
PART	CODE	COURSE	TITLE	HRS	MARKS		TOTAL	CREDIT
			I SEMESTER		IA	WE		
I	B1T1	LT	Language - Tamil	6	25	75	100	3
II	B1E1	LE	English	6	25	75	100	3
III	B1CH1	CC1	General Chemistry - I	6	25	75	100	5
III	B1CH2P	CC2	Volumetric Quantitative Estimation	3	25	75	100	3
III	B1AMA1	Allied 1	Algebra & Differential Calculus	4	25	75	100	4
	B1AZO1		Zoology - I					
III	B2AMA2	Allied 2	Vector Analysis & Analytical Geometry	3	-	-	-	-
	B2AZO2P		Zoology Practical					
IV	B1VE	VE	Value Education	2	25	75	100	2
			TOTAL	30			600	20
			II SEMESTER		IA	WE		
I	B2T2	LT	Language - Tamil	6	25	75	100	3
II	B2E2	LE	English	6	25	75	100	3
III	B2CH3	CC3	General Chemistry - II	6	25	75	100	5
III	B2CH4P	CC4	Qualitative Organic Analysis	3	25	75	100	3
III	B2AMA2	Allied 2	Vector Analysis & Analytical Geometry	3	25	75	100	4
	B2AZO2P		Zoology Practical					
III	B2AMA3	Allied 3	Integration and Laplace Transforms	4	25	75	100	4
	B2AZO3		Zoology - II					
IV	B2ES	ES	Environmental Studies	2	25	75	100	2
			TOTAL	30			700	24

PART	CODE	COURSE	TITLE	HRS	MARKS		TOTAL	CREDIT
			III SEMESTER		IA	WE		
I	B3T3	LT	Language - Tamil	6	25	75	100	3
II	B3E3	LE	English	6	25	75	100	3
III	B3CH5	CC5	General Chemistry - III	6	25	75	100	5
III	B3CH6P	CC6	Qualitative Inorganic Analysis	3	25	75	100	3
III	B3APH1	Allied 4	Integrated Physics - I	4	25	75	100	4
III	B4APHP	Allied 5	Physics Practical	3	-	-	-	-
IV	B3CHSE1	SEC1	Polymer Chemistry	2	25	75	100	2
IV	B3HW	HW	Health and Wellness	-	-	-	-	1
IV	B3NCC1	NCC-1	Introduction to NCC (for NCC Students only)	-			100	2
			TOTAL	30			600	21
			IV SEMESTER		IA	WE		
I	B4T4	LT	Language - Tamil	6	25	75	100	3
II	B4E4	LE	English	6	25	75	100	3
III	B4CH7	CC7	General Chemistry - IV	6	25	75	100	5
III	B4CH8P	CC8	Gravimetric Quantitative Estimation	3	25	75	100	3
III	B4APHP	Allied 5	Physics Practical	3	25	75	100	4
III	B4APH2	Allied 6	Integrated Physics - II	4	25	75	100	4
IV	B4CHSE2	SEC2	Instrumental Methods of Chemical Analysis	2	25	75	100	2
IV	B4NCC2	NCC-2	Specialized Subjects - ARMY (for NCC Students Only)	-	25	75	100	2
			TOTAL	30			700	24

PART	CODE	COURSE	TITLE	HRS	MARKS		TOTAL	CREDIT
			V SEMESTER		IA	WE		
III	B5CH9	CC9	Organic Chemistry - I	6	25	75	100	5
III	B5CH10	CC10	Inorganic Chemistry - I	5	25	75	100	5
III	B5CH11	CC11	Physical Chemistry - I	6	25	75	100	5
III	B5CH12P	CC12	Physical Chemistry Practical	3	25	75	100	3
III	B5CHEC1	EC1	Industrial Chemistry	5	25	75	100	4
IV	B5CHNMEC1	NMEC1	Non-Major Elective - I	3	25	75	100	2
IV	B5CHSE3	SEC3	Food Chemistry	2	25	75	100	2
IV	B5DM	DM	Disaster Management	-	-	-	-	2
IV		Internship	Internship	-	-	-	-	2
			TOTAL	30			700	30

PART	CODE	COURSE	TITLE	HRS	MARKS		TOTAL	CREDIT
			VI SEMESTER		IA	WE		
III	B6CH13	CC13	Organic Chemistry - II	6	25	75	100	5
III	B6CH14	CC14	Inorganic Chemistry - II	6	25	75	100	5
III	B6CH15P	CC15	Preparation of Organic and Inorganic Compounds	3	25	75	100	3
III	B6CHEC2	EC2	Physical Chemistry - II	6	25	75	100	5
IV	B6CHNMEC2	NMEC2	Non-Major Elective - II	3	25	75	100	2
IV	B6CHSE4	SEC4	Fundamentals of spectroscopy	4	25	75	100	2
IV	B6GS	GS	Gender Studies	2	25	75	100	2
V		Ext. Activities	Extra-Curricular Activities	-	-	-	-	1
			TOTAL	30			700	25
			GRAND TOTAL				4000	144

		Papers	Total Credit	Partwise Credit	Marks
PART-I	TAMIL	4x3	12	12	400
PART-II	ENGLISH	4x3	12	12	400
PART-III	CORE	9X5=45;6X3=18	63	96	1500
	ELECTIVES	1x5=5;1x4=4	9		300
	ALLIED	6x4	24		600
PART - IV	NON-MAJOR	2X2	4	23	100
	ES, VE	2X2	4		200
	SKILL BASED	4X2	8		400
	GS	1x2	2		100
	DM		2		
	INTERNSHIP		2		
	HW		1		
PART - V	EXT. ACTIVITIES		1	1	
TOTAL PAPERS -		38	TOTAL	144	4000

Title of the Course	GENERAL CHEMISTRY-I						
Paper No.	CC1						
Category	Core	Year	I	Credits	5	Course Code	B1CH1
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	1	-		6		
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 the chemical behavior • 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; 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 (A t o m i c n u m b e r 1 - 5 0) - Hund’s rule, Pauli’s exclusion principle and Aufbau principle; Numerical problems involving the core concepts.						
	UNIT II: Quantum Mechanics and Periodicity Introduction to Quantum Mechanics Classical mechanics, Wave mechanical model of the atom, distinction between a Bohr orbit and an orbital; Postulates of quantum mechanics; probability interpretation of wave functions, 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 polarization – polarizing power and polarizability; Fajans’ rules - effects of polarization 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 AB₂, AB₃, AB₄, AB₅, AB₆ and AB₇. UNIT IV: Structure and Bonding – II VB theory – application to the hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO₂, NO₂, CO₃²⁻, NO₃⁻; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H₂, C₂, O₂, O₂⁺, O₂²⁻, N₂, NO, HF, CO; magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of BF₃-NH₃, NH₄⁺, H₃O⁺ properties Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors. 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, and carbenes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductive 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
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Extended Professional Component (is a part of the 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	1. Madan, R. D. and Sathya Prakash, <i>Modern Inorganic Chemistry</i>, 2nded.; S. Chand and Company: New Delhi, 2003. 2. Rao, C.N. R. University General Chemistry, Macmillan Publication: New Delhi, 2000. 3. Bahl, B. S. and Bahl, A. A Textbook of Organic Chemistry, 23rd ed.; S. Chand Publishing: New Delhi, 2025. 4. Puri, B.R. and Sharma, L.R. <i>Principles of Physical Chemistry</i>, 38thed.; Vishal Publishing Company: Jalandhar, 2002. 5. Bruce, P. Y. and Prasad K. J. R. <i>Essential Organic Chemistry</i>, Pearson Education: New Delhi, 2008. 6. Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi, 2016
Reference Books	1. Maron, S. H. and Prutton C. P. <i>Principles of Physical Chemistry</i>, 4thed.; The Macmillan Company: New York, 1972. 2. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4th ed.; ELBS William Heinemann: London, 1991. 3. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i>, 26thed.; Goel Publishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. <i>Physical Chemistry</i>, 10th ed.; Oxford University Press: New York, 2014. 5. Huheey, J.E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, 4th ed.; Addison, Wesley Publishing Company: India, 1993.
Website and e-learning source	1) https://onlinecourses.nptel.ac.in 2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm 3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html 4) https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding 5) https://www.chemtube3d.com/

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

- CO1:** explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.
- CO2:** classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.
- CO3:** apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx , Δp electronegativity, percentage ionic character and bond order.
- CO4:** evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects
- CO5:** construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.

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

CO-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
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'**Signature of the HOD**

Title of the Course	VOLUMETRIC QUANTITATIVE ESTIMATION						
Paper No.	CC2						
Category	Core	Year	I	Credits	3	Course Code	B1CH2P
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	3		3		
Prerequisites	Higher secondary chemistry						
Objectives of the course	This course aims to provide knowledge on • Laboratory safety practices, chemical hazards, and safe handling of chemicals. • Identification and proper use of common laboratory apparatus. • Principles of volumetric analysis and preparation of standard solutions. Different titrimetric methods for quantitative estimation of substances. • Calculation, analysis, and interpretation of experimental results.						
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.
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	Reference Books: 1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. <i>Basic Principles of Practical Chemistry</i>, 2nded.; Sultan Chand & Sons: New Delhi, 1997. 2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; <i>An advanced course in Practical Chemistry</i>, 3rd ed.; New Central Book Agency: Kolkata, 2007.
Reference Books	1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; <i>Vogel's Textbook of Quantitative Chemical Analysis</i> , 6 th ed.; Pearson Education Ltd: New Delhi, 2000.
Website and e-learning source	Web References: 1) http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis 2) https://chemdictionary.org/titration-indicator/
Course Learning Outcomes (for Mapping with POs and PSOs) On successful completion of the course the students should be able to CO1: explain the basic principles involved in titrimetric analysis and inorganic preparations. CO2: compare the methodologies of different titrimetric analyses. 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

Level of Correlation between PSO's and CO's

Signature of the HOD

Credits	: 2	Hours/Week	: 2
Medium of Instruction	: English/Tamil	Code:	BIVE

இளநிலை பட்ட வகுப்பு - பகுதி IV

(2026 - 2027 ஆம் கல்வியாண்டு முதல் சேர்க்கப்பட்ட மாணவர்களுக்குரியது)

முதல் பருவம்

மதிப்புக் கல்வி (Value Education)

OBJECTIVES:

- ✓ To understand the philosophy of life and values through Thirukural
- ✓ To analyse the components of values education to attain the sense of citizenship
- ✓ To understand different types of values towards National Integration and international understanding
- ✓ To learn yoga as value education to promote mental and emotional health
- ✓ To understand human rights, women rights and other rights to promote peace and harmony

UNIT I: PHILOSOPHY OF LIFE AND SOCIAL VALUES (வாழ்க்கை தத்துவம் மற்றும்

சமூக விழுமியங்கள்)

Human Life on Earth (Kural 629) -Purpose of Life (Kural 46) -Meaning and Philosophy of Life (Kural 131, 226) -Family (Kural 45), Peace in Family (Kural 1025) Society (Kural 446), The Law of Life (Kural 952), Brotherhood (Kural 807) Five responsibilities / duties of Man (a) to himself (b) to his family (c) to his environment (d) to his society, (e) to the Universe in his lives (Kural 43, 981).

பூமியில் மனித வாழ்க்கை (குறள் 629) -வாழ்க்கையின் நோக்கம் (குறள் 46)- வாழ்க்கையின் பொருளும் தத்துவமும் (குறள் 131, 226)-குடும்பம் (குறள் 45)- குடும்பத்தில் அமைதி / நல்வாழ்வு (குறள் 1025) -சமூகம் (குறள் 446)-வாழ்க்கையின் நெறி / சட்டம் (குறள் 952)-சகோதரத்துவம் / நட்புடைமை (குறள் 807). மனிதனின் ஐந்து கடமைகள்/பொறுப்புகள் அ) தனக்குத்தானே செய்யும் கடமை ஆ) தனது குடும்பத்திற்குச் செய்யும் கடமை இ) தனது சுற்றுப்புறத்திற்கு/இயற்கைக்குச் செய்யும் கடமை ஈ) தனது சமூகத்திற்குச் செய்யும் கடமை உ) இவ்வுலகிற்கு/பேரண்டத்திற்குச் செய்யும் கடமை

UNIT II: HUMAN VALUES AND CITIZENSHIP (மனித விழுமியங்களும் குடியுரிமையும்)

Aim of education and value education: Evolution of value-oriented education, Concept of Human values: types of Values- Character Formation – Components of Value education-A P J Kalam's ten points for enlightened citizenship- The role of media in value building

கல்வி மற்றும் விழுமியக் கல்வியின் நோக்கம்: விழுமியம் சார்ந்த கல்வியின் பரிணாம வளர்ச்சி: மனித விழுமியங்களின் கோட்பாடு: விழுமியங்களின் வகைகள்: பண்பு நலம்

உருவாக்குதல் / குணநலன் உருவாக்கம்: விழுமியக் கல்வியின் கூறுகள்: அறிவுசார்ந்த / விழிப்புணர்வுள்ள குடியுரிமைக்கான ஏ. பி. ஜே. அப்துல் கலாமின் பத்து கட்டளைகள் - விழுமியங்களை உருவாக்குவதில் ஊடகங்களின் பங்கு.

UNIT-III VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL (தேசிய மற்றும் உலகளாவிய வளர்ச்சியை நோக்கிய கல்வி)

DEVELOPMENT:

Constitutional or national values: Democracy, socialism, secularism, equality, Justice, liberty, freedom and fraternity - Social Values: Pity and probity, self-control, universal brotherhood - Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith -Religious Values: Tolerance, wisdom, character – Aesthetic Values- Love and appreciation of literature and fine arts and respect for the same- National Integration and International Understanding.

அரசியலமைப்பு அல்லது தேசிய விழுமியங்கள்: மக்களாட்சி, சமதர்மம், மதச்சார்பின்மை, சமத்துவம், நீதி, சுதந்திரம் மற்றும் சகோதரத்துவம். சமூக விழுமியங்கள்: இரக்கமும் நேர்மையும், சுயக்கட்டுப்பாடு, உலகளாவிய சகோதரத்துவம். தொழில்சார் விழுமியங்கள்: அறிவுத் தாகம், தொழிலில் நேர்மை, ஒழுங்குமுறை, குறித்த நேரத்தில் செயல்படுதல் மற்றும் நம்பிக்கை. சமய விழுமியங்கள்: சகிப்புத்தன்மை, ஞானம், நற்பண்பு. அழகியல் விழுமியங்கள்: இலக்கியம் மற்றும் நுண்கலைகள் மீதான அன்பு, பாராட்டு மற்றும் அவற்றிற்கான மரியாதை. தேசிய ஒருமைப்பாடு மற்றும் சர்வதேச புரிதல்.

UNIT IV : YOGA AND HEALTH (யோகாவும் ஆரோக்கியமும்):

Definition, Meaning, Scope of Yoga - Aims and objectives of Yoga – Yoga Education with modern context - Different traditions and schools of Yoga – Yoga practices: Asanas, Pranayama and Meditation.

யோகா-வரையறை, பொருள், வரம்பு; யோகாவின் நோக்கங்களும் குறிக்கோள்களும். நவீன சூழலில் யோகா கல்வி. யோகாவின் பல்வேறு மரபுகளும் நெறிகளும். யோகா பயிற்சிகள்: ஆசனங்கள், பிராணாயாமம் மற்றும் தியானம்.

UNIT V : HUMAN RIGHTS (மனித உரிமைகள்):

Concept of Human Rights: Indian and international perspectives- Evolution of Human Rights-definitions under Indian and International documents -Broad classification of Human Rights and Relevant Constitutional Provisions: Right to Life, liberty and Dignity- Right to equality- Right against exploitation- Cultural and Educational Right- Economic Rights- Political Rights- Social Rights - Human Rights of Women and Children – Peace and harmony.

மனித உரிமைகள் கோட்பாடு: இந்திய மற்றும் சர்வதேச கண்ணோட்டங்கள். மனித உரிமைகளின் பரிணாம வளர்ச்சி. இந்திய மற்றும் சர்வதேச ஆவணங்களின்படியான வரையறைகள். மனித உரிமைகளின் பரந்த வகைப்பாடும் தொடர்புடைய அரசியலமைப்பு விதிகளும்: வாழ்வுரிமை, சுதந்திரம் மற்றும் கண்ணியத்திற்கான உரிமை - சமத்துவ உரிமை - சுரண்டலுக்கு எதிரான உரிமை - கலாச்சார மற்றும் கல்வி உரிமை - பொருளாதார உரிமைகள் - அரசியல் உரிமைகள் - சமூக உரிமைகள். பெண்கள் மற்றும் குழந்தைகளுக்கான மனித உரிமைகள். அமைதி மற்றும் நல்லிணக்கம்.

BOOKS FOR REFERENCES:

1. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road, Thanjavur 613 004
2. Leah Levin, Human Rights, NBT, 1998
3. V.R. Krishna Iyer, Dialectics and Dynamics of Human Rights in India, Tagore Law Lectures.
4. Yogic Therapy - Swami Kuvalayananda and Dr.S.L.Vinekar, Government of India, Ministry of Health, New Delhi.
5. SOUND HEALTH THROUGH YOGA - Dr.K.Chandrasekaran, Prem Kalyan Publications, Sedapatti, 1999.
6. Grose. D. N – “A text book of Value Education” New Delhi (2005)
7. Gawande . EN – “Value Oriented Education” – Vision for better living. New Delhi (2002) Saruptsons
8. Brain Trust Aliyar- “Value Education for Health, Happiness and Harmony” Erode (2004) Vethathiri publications

COURSE OUTCOMES: After completion of the course, the student will be able to:

- ✓ Apply the values in thirukural to be peaceful, dutiful and responsible in family and society
- ✓ Develop character formation and sense of citizenship
- ✓ Be secular, self-control, sincere, respectful and moral.
- ✓ Master yoga, asana and meditation to promote mental health
- ✓ Be attitudinal to follow the constitutional rights

Question Paper Pattern

Maximum Marks : 75

Exam Duration : 3 Hours

Part A - 5 x 6 = 30 (Either Or Type, Two Question from each Unit)

Part B - 3 x 15 = 45 (3 Out of 5, One Question from each Unit)

Title of the Course	GENERAL CHEMISTRY-II						
Paper No.	CC3						
Category	Core	Year	I	Credits	5	Course Code	B2CH3
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	1	-		6		
Prerequisites	General Chemistry - II						
Objectives of the course	This course aims to provide 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						
Course Outline	UNIT I: Acids, Bases and Ionic Equilibria Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators; Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation.						
	Unit II: Chemistry of s - Block Elements Hydrogen: Position of hydrogen in the periodic table.: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Chemistry of p- Block Elements (Group 13 & 14) Preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Comparison of carbon with silicon. Carbon disulfide – Preparation, properties, structure and uses. Carbon Nanomaterials Basic concepts of carbon nanomaterials - types, unique properties, and their applications.						
	UNIT III: Chemistry of p- Block Elements (Groups 15-18) General characteristics of elements of Group 15: Chemistry of H ₂ N-NH ₂ , NH ₂ OH, NH ₃ , and HNO ₃ . Chemistry of PH ₃ , PCl ₃ , PCl ₅ , POCl ₃ , P ₂ O ₅ and oxy acids of phosphorous (H ₃ PO ₃ and H ₃ PO ₄) General properties of elements of group 16 - Structure and allotropy of elements - Chemistry of ozone - Classification and properties of oxides – oxides of sulphur and selenium Oxyacids of sulphur (Caro's and Marshall's acids).						

	Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids (HClO₄). Inter-halogen compounds (ICl, ClF₃, BrF₅ and IF₇), pseudo halogens [(CN)₂ and (SCN)₂] and basic nature of Iodine. Noble gases: Position in the periodic table. Structure of XeF₂, XeF₄, XeF₆ and XeOF₄; uses of noble gases - clathrate compounds.
	UNIT IV: Hydrocarbon Chemistry-I Alkenes-Nomenclature, general methods of preparation – Mechanism of elimination reactions – E1 and E2 mechanisms - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis and polymerization. Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerization and isomerization. Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations.
	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-Crafts alkylation and acylation. Mono- and disubstituted benzene - Effect of substituent – orientation and reactivity. Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at o- and p-positions – reduction, oxidation – uses. Anthracene – synthesis by Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses. 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. Madan RD, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed., S.Chand and Company, New Delhi. 2. Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S. Chand and Company, New Delhi. 3. Poole, C. P. Jr. and Owens, F. J., <i>Introduction to Nanotechnology</i>; Wiley-Interscience: New Jersey. 4. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi. 5. Tewari K S, Mehrotra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi. 6. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar.
Reference books	1. Maron S Hand Prutton CP, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, New York. 2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi. 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London. 4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India. 5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed., Goel Publishing House, Meerut. 6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8th ed., Goel Publishing House, Meerut.
Website and e-learning source	https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/sblack/chem1010/lecture_notes/4B.html http://www.auburn.edu/~deruija/pdareson.pdf https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding MOOC components http://nptel.ac.in/courses/104101090/ 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 p block elements, preparation and properties of aliphatic and aromatic hydrocarbons
- CO2:** discuss the periodic properties of sand p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids
- CO3:** classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons
- CO4:** explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements
- CO5:** assess the application of hard and soft acids indicators, buffers, compounds of s and p- block elements and hydrocarbons

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

Signature of the HOD

Title of the Course	QUALITATIVE ORGANIC ANALYSIS						
Paper No.	CC4						
Category	Core	Year	I	Credits	3	Course Code	B2CH4P
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	3		3		
Prerequisites	General Chemistry II						
Objectives of the course	This course aims to provide knowledge on: • Basic laboratory safety practices, symbols, first-aid procedures, and safe handling of chemicals. • Operation of Bunsen burner and proper use of common chemistry laboratory glassware. • Principles and procedures involved in qualitative organic analysis. • Detection of elements and identification of organic compounds based on functional groups. • Preparation of organic derivatives and confirmation of functional groups.						
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 un saturation, identification of functional groups using solubility tests Confirmation of functional groups • mono carboxylic acid, di carboxylic acid • mono hydric phenol, polyhydric phenol • aldehyde, ketone, ester • carbohydrate (reducing and non-reducing sugars) • primary, secondary, tertiary amine • mono amide, diamide, thioamide • anilide, nitro compound • Preparation of derivatives for functional groups						

Reference Books	1. Venkateswaran, V.; Veeraswamy, R. Kulandaivelu, A.R. <i>Basic Principles of Practical Chemistry</i> , 2 nd ed.; Sultan Chand: New Delhi, 2012. 2. Manna, A.K. <i>Practical Organic Chemistry</i> , Books and Allied: India, 2018. 3. Gurtu, J. N; Kapoor, R. <i>Advanced Experimental Chemistry (Organic)</i> , Sultan Chand: New Delhi, 1987. 4. Furniss, B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. <i>Vogel's Textbook of Practical Organic Chemistry</i> , 5 th ed.; Pearson: India, 1989.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

After completion of this course, students will be able to:

- CO1:** Follow safety rules and demonstrate safe practices in the chemistry laboratory.
CO2: Handle laboratory equipment and glassware effectively for chemical experiments.
CO3: Perform preliminary tests and detect elements present in organic compounds.
CO4: Identify different organic functional groups using qualitative analysis methods.
CO5: Prepare derivatives and characterize unknown organic compounds based on analytical results.

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

Signature of the HOD

ENVIRONMENTAL STUDIES							
(for students admitted from the academic year 2026-2027)							
Credit	2	Hours/Week	2	Sub Code	B2ES	Semester	II
Medium of Instruction: English/Tamil						ES	

Objective:

To sensitize students on environmental issues and sustainable development practices.

Course outcomes:

Co No.	Co – Statements	Cognitive Levels
	<i>On successful completion of this course, students will be able to</i>	
CO - 1	understand the concept, structure and functions of various ecosystems.	K1, K2
CO - 2	distinguish renewable resources from non-renewable resources	K3, K4
CO - 3	value the importance of biodiversity and its conservation.	K3
CO - 4	rationalize social issues with environmental issues and realize the importance of the environment and aware of its protection	K4
CO - 5	gain knowledge on human role in environment management and conservation	K5

Unit 1

The Multidisciplinary nature of environmental studies: Scope and importance; Need for public awareness. Natural Resources: Renewable and non-renewable resources; Natural resources and associated problems - a) Forest resources, b) Water resources, c) Mineral resources, d) Food resources, e) Energy resources, f) Land resources Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

சுற்றுச்சூழல் அறிவியல்-பல்துறைதன்மை:

நோக்கம் மற்றும் முக்கியத்துவம்;

மக்களிடம் விழிப்புணர்வு தேவை.

இயற்கைவளங்கள்:

புதுப்பிக்கத்தக்க மற்றும் புதுப்பிக்க இயலா வளங்கள்;

இயற்கைவளங்கள் மற்றும் பயன்பாடு தொடர்புடைய பிரச்சனைகள் - அ) வனவளங்கள், ஆ) நீர்வளங்கள், இ) கரிமவளங்கள், ஈ) உணவுவளங்கள், உ) ஆற்றல்வளங்கள், ஊ) நிலவளங்கள்.

இயற்கைவளங்களைப் பாதுகாப்பதில் தனிநபரின் பங்கு.

நிலையான வாழ்க்கை முறைக்கு வளங்களை சமமாகப் பயன்படுத்துதல்.

Unit II

Ecosystem: Concept, structure and function of an ecosystem; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

சுற்றுச்சூழல் அமைப்பு: கட்டமைப்பும் செயல்பாடு; சுற்றுச்சூழல் அமைப்பில் ஆற்றல் ஓட்டம்;

சுற்றுச்சூழல் தொடர்வழி மாற்றம்; உணவு சங்கிலி, உணவு வலை மற்றும் சுற்றுச்சூழல் கூம்புகள்; அறிமுகம், வகைகள், சிறப்பியல்பு, கட்டமைப்பும் செயல்பாடு - அ) வன சுற்றுச்சூழல், ஆ)

புல்வெளிக் கற்றுச் சூழல், இ) பாலவனகற்றுச் சூழல், ஈ) நீர்வாழ்க் கற்றுச் சூழல் அமைப்புகள் (குளங்கள், நீரோடைகள், ஏரிகள், ஆறுகள், பெருங்கடல்கள், முகத்துவாரங்கள்).

Unit III

Biodiversity and its conservation: Genetic, species and ecosystem diversity; Biogeographical classification of India; Value of biodiversity; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity; Endangered and endemic species of India; In-situ and Ex-situ conservation of biodiversity. Environmental Pollution: Definition, causes, effects and control measures of a) Air Pollution, b) Water Pollution, c) Soil Pollution, d) Marine Pollution, e) Noise pollution, f) Thermal Pollution, g) Nuclear hazards, h) solid waste; Role of an individual in prevention of pollution; Pollution case studies; Disaster management - floods, earthquake, cyclone and landslides.

பல்லுயிர் மற்றும் அதன் பாதுகாப்பு: மரபணு, இனங்கள் மற்றும் சுற்றுச்சூழல் பன்முகத்தன்மை; இந்தியாவின் உயிர் புவியியல் வகைப்பாடு; பல்லுயிர் மதிப்பு; உலகளாவிய, தேசிய மற்றும் உள்ளூர் மட்டங்களில் பல்லுயிர்; இந்தியா ஒரு பெரும்-பன்முகத்தன்மை கொண்ட நாடு; பல்லுயிர் பெருக்கத்தின் செழுமை இடங்கள்; பல்லுயிர் பெருக்கத்திற்கு அச்சுறுத்தல்கள்; இந்தியாவின் அழிந்துவரும் மற்றும் உள்ளூர் இனங்கள்; அக-புறச் சூழல் பல்லுயிர் பாதுகாப்பு. சுற்றுச்சூழல் மாசுபாடு: வரையறை, காரணங்கள், விளைவுகள் மற்றும் கட்டுப்பாட்டு நடவடிக்கைகள் அ) காற்று மாசுபாடு, ஆ) நீர் மாசுபாடு, இ) மண் மாசுபாடு, ஈ) கடல் மாசுபாடு, உ) ஒலி மாசுபாடு, ஊ) வெப்ப மாசுபாடு, எ) அணு அபாயங்கள், ஏ) திடமான கழிவுகள்; மாசுபாட்டை தடுப்பதில் தனிநபரின் பங்கு; மாசுகள் ஆய்வுகள்; பேரிடர் மேலாண்மை - வெள்ளம், பூகம்பம், சூறாவளி மற்றும் நிலச்சரிவு.

Unit IV

Social Issues and the Environment: from Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people – problems, concerns, case studies; Environmental ethics; Climate change; Global warming; Acid rain; Ozone layer depletion; Nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products; Environmental Legislations - Environment Protection Act; Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.; Issues involved in enforcement of environmental legislation; Public awareness.

சுற்றுச்சூழல் சார்ந்த சமூகப் பிரச்சினைகள்: நீடித்த வளர்ச்சி, நிலையான வளர்ச்சி வரை; ஆற்றல்தொடர்பான நகர்ப்புற பிரச்சினைகள்; நீர் சேமிப்பு, மழை நீர் சேகரிப்பு, நீர் நிலை மேலாண்மை; மக்களின் மீள்குடியேற்றம் மற்றும் மறுவாழ்வு - பிரச்சினைகள், கவலைகள், வழக்கு ஆய்வுகள்; சுற்றுச்சூழல் நெறிமுறைகள்; பருவநிலை மாற்றம்; உலக வெப்பமயமாதல்; அமில மழை; ஓசோன் அடுக்கு சிதைவு; அணுவிபத்துக்கள் மற்றும் மரணங்கள்; தரிக் நிலமீட்டல்; நுகர்வோர் மற்றும் கழிவு பொருட்கள்; சுற்றுச்சூழல் சட்டங்கள் - சுற்றுச்சூழல் பாதுகாப்பு சட்டம்; காற்று (மாசு தடுப்பு மற்றும் கட்டுப்பாடு) சட்டம், நீர் (தடுப்பு மற்றும் மாசு கட்டுப்பாடு) சட்டம், வனவிலங்கு பாதுகாப்பு சட்டம், வன பாதுகாப்பு சட்டம்.; சுற்றுச்சூழல் சட்டத்தை அமல்படுத்துவதில் உள்ள சிக்கல்கள்; பொது விழிப்புணர்வு.

Unit V

Human Population and the Environment: Population growth, Variation among nations, Population explosion, Family Welfare Programmes, Environment and human health, Human Rights, Value Education, HIV/ AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health.

மக்கள்தொகைமற்றும்சுற்றுச்சூழல்: மக்கள்தொகைவளர்ச்சி, நாடுகளிடையேமாறுபாடு, மக்கள்தொகைபெருக்கம், குடும்பநலத்திட்டங்கள், சுற்றுச்சூழல்மற்றும்மனிதஆரோக்கியம், மனிதஉரிமைகள், மதிப்புக்கல்வி, எச்ஐவி/எய்ட்ஸ், பெண்கள்மற்றும்குழந்தைகள்நலன், சுற்றுச்சூழல்மற்றும்மனிதஆரோக்கியத்தில்தகவல்தொழில்நுட்பத்தின்பங்கு.

Text books

1. Erach Bharucha, 2004. Textbook for Environmental studies, UGC, New Delhi.
2. Townsend C.R., Harper, J.L., Begon, M., 2009. Essentials of Ecology, Wiley, 528p.
3. N. Arumugam, V. Kumaresan. 2014. Environmental Studies. Saras Publication

Reference books

1. Abbasi, S.A., 1998. Environmental Pollution and its Control, International Publications, Pondichery.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Public Ltd Bikaner.
3. Clark R.B., 2001. Marine Pollution, 5th edition, Oxford University Press. 248p.
4. Jadhav, H and Bhosale, V.M., 1995. Environmental Protection and Laws Himalaya Pub. House, Delhi 284 p.
5. McNeely, J.A., Miller, K., Mittermeier, R.A., Reid, W.V and Werner, T.B., 1990. Conserving the world's biological diversity, IUCN.
6. Odum, E.P. 1971 Fundamentals of Ecology. W.B. Saunders Co. USA. 574 p.
7. Trivedi R.K., 2010. Handbook of Environmental Laws, Acts, Guidelines, Compliances and Standards, Vol. I and II, B.S. Publications.

Web Resources

- <https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf>
- https://www.researchgate.net/publication/349648232_Introduction_to_Environmental_Studies
- https://nitsri.ac.in/Department/CHEMISTRY/EVS_MATERIAL_2.pdf

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Course Outcome s	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean Score of COs
CO1	3	2	2	3	3	3	3	2	3	1	2.5
CO2	3	3	3	3	3	3	1	3	2	3	2.7
CO3	3	3	3	2	3	3	1	3	3	3	2.7
CO4	3	3	3	3	3	3	1	3	1	3	2.6
CO5	1	3	3	3	3	3	1	1	1	3	2.2
Mean Overall Score											2.54
Result											High

Question Pattern:

Maximum Marks: 75

Duration of Exam: 3 hrs

Part A: 5 x 6 = 30 (5 out of 7 questions, at least one question from each unit)

Part B: 3 x 15 = 45 (One question from each unit)

Title of the Course	GENERAL CHEMISTRY -III						
Paper No.	CC5						
Category	Core	Year	II	Credits	5	Course Code	B3CH5
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	1	-		6		
Prerequisites	General Chemistry – I and II						
Objectives of the course	This course aims to provide comprehensive knowledge of • 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 aromatic alcohols. • Preparation and properties of phenols and alcohols.						
Course Outline	UNIT I: Gaseous State Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell –Boltzmann distribution of speed of molecules- average, root-mean-square, and most probable velocity and average kinetic energy; law of equipartition of energy; degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases. Real gases: Deviations from ideal gas behavior (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 Waals’ 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 .						
	UNIT II: Liquid and Solid State Properties of Liquids- Surface tension, viscosity and their applications. Solids- Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Crystals –size and shape; laws of crystallography; 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;						

	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; Fajans–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 the 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 and Aliphatic Alcohols 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 the 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, 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 and Aromatic Alcohols Phenols Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gattermann synthesis, Libermann, nitro reaction, phthalein reaction. Resorcinol, quinol, picric acid – structure 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.
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, are 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. B.R. Puri, L.R. Sharma, M.S. Pathania; <i>Principles of Physical Chemistry</i> , 46 th edition, Vishal Publishing, 2020. 2. B.R. Puri, L.R. Sharma and K.C. Kalia, <i>Principles of Inorganic Chemistry</i> , Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009. 3. Madan, R. D. and Sathya Prakash. <i>Modern Inorganic Chemistry</i> , 2nd ed.; S. Chand and Company: New Delhi, 2003. 4. 4. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i> , Sultan Chand & amp; Sons, twentieth edition, 2006. 5. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i> , Vishal Publishing, fourth reprint, 2003. 6. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i> , Macmillan India Ltd., third edition, 1994.
Reference Books	1. T. W. Graham Solomons, <i>Organic Chemistry</i> , John Wiley & amp; Sons, fifth edition, 1992. 2. A. Carey Francis, <i>Organic Chemistry</i> , Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, 2009. 3. I. L. Finar, <i>Organic Chemistry</i> , Wesley Longman Ltd, England, sixth edition, 1996.

	4. P. L. Soni, and H. M. Chawla - <i>Text Book of Organic Chemistry</i>, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007. 5. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science, fifth edition, 2005.
Website and e-learning source	MOOC components https://nptel.ac.in/courses/104104101Solid state chemistry https://nptel.ac.in/courses/103106071Nuclear industries and safety https://nptel.ac.in/courses/104106119sIntroduction to organic chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain the kinetic properties of gases by using mathematical concepts.

CO2: describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations.

CO3: investigate the radioactivity, nuclear energy and its production, also the nuclear waste management.

CO4: write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.

CO5: investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

Signature of the HOD

Title of the Course	QUALITATIVE INORGANIC ANALYSIS						
Paper No.	CC6						
Category	Core	Year	II	Credits	3	Course Code	B3CH6P
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	1	-	2		3		
Prerequisites	General chemistry						
Objectives of the course	To develop the skill in systematic analysis of simple inorganic salts and mixtures of salts.						
Course Outline	Semi - Micro Qualitative Analysis 1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphate, chloride, bromide. 2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite. 3. Elimination of interfering acid radicals and Identifying the group of basic radicals 4. Analysis of basic radicals (group-wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium 5. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is an 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**Signature of the HOD**

Title of the Course	POLYMER CHEMISTRY						
Paper No.	SEC 1						
Category	SEC Course	Year Semester	II III	Credits	2	Course Code	B3CHSE1
	Lecture	Tutorial	Lab Practice				
Instructional hours per week	2					2	
Prerequisites	General Chemistry						
Objectives of the course	This course aims to provide a comprehensive knowledge on: • Basic concepts, classification, and nomenclature of polymers. • Polymerization mechanisms and copolymerization techniques. • Molecular weight, thermal properties, and characterization of polymers. • Synthesis, properties, and applications of commercial polymers. • Polymer degradation, recycling, and biodegradable polymers.						
Course Outline	Unit 1: Introduction and Classification of Polymers Basic Concepts - Monomer, polymer, functionality, degree of polymerization (DP), and repeating units - Classification of Polymers - Based on origin (Natural, semi-synthetic, synthetic) - Based on structure (Linear, branched, cross-linked) - Based on intermolecular forces (Elastomers, fibers, thermoplastics, and thermosets)						
	Unit II: Mechanisms of Polymerization Addition (Chain-Growth) Polymerization - General mechanisms of free radical, cationic, and anionic polymerization - Condensation (Step-Growth) Polymerization - General mechanism – Copolymerization.						
	Unit III: Polymer Molecular Weights and Properties Molecular Weight Concepts - Average molecular weights - Number-average (Mn) and Weight-average (Mw) molecular weights - Polydispersity Index (PDI) - Determination of Molecular Weight by Viscometry - Thermal Properties - Glass Transition Temperature (Tg), factors affecting Tg and its importance.						
	Unit IV: Commercial Polymers Synthesis, Properties, and Applications of Industrial Polymers - Plastics: Polyethylene (LDPE & HDPE), Polyvinyl chloride (PVC), and Polystyrene (PS) - Fibers: Nylon 6,6 and Polyesters (PET) - Thermosets and Elastomers: Bakelite, Natural Rubber (vulcanization), and Buna-S.						
	Unit V: Polymer Degradation and Green Chemistry Polymer Degradation - Brief overview of thermal, oxidative, and photo-degradation - Environmental Concerns - Plastic waste management, microplastics, and recycling strategies (Mechanical and Chemical) - Sustainable Chemistry - Introduction to biodegradable polymers like PLA (Polylactic acid).						

Skills acquired from this course	Knowledge of polymer chemistry, problem-solving skills, analytical ability, competency in polymer preparation and applications, scientific communication, and transferable skills in polymer-based industries.
Recommended Text	1. V. R. Gowarikar, N. V. Viswanathan "Polymer science", Wiley Eastern Ltd., New Delhi, 1978. 2. M. G. Arora, M. Singh and M. S. Yadav "Polymer Chemistry" 2 nd Revised edition, Anmol Publications Private Ltd., New Delhi, 1989
Reference Books	1. F. W. Bilmeyer, "Text book of Polymer Science", Jr. John Wiley and Sons, 1984. 2. B. K. Sharma "Polymer Chemistry", Goel Publishing House, Meerut, 1989. 3. Misra, G. S., <i>Introductory Polymer Chemistry</i> , New Age International Publishers.
Website and e-learning source	1. https:// www.chemistryguide.org/ 2. https://chemcollective.org/home
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course, the students should be able to: CO1: Understand the basic concepts, classification, and nomenclature of polymers. CO2: Explain the mechanisms of polymerization and copolymerization. CO3: Analyze polymer molecular weight, characterization methods, and thermal properties. CO4: Describe the synthesis, properties, and applications of commercially important polymers. CO5: Evaluate polymer degradation, recycling techniques, and biodegradable polymers for sustainable applications.	

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

CO-PO Mapping (Course Articulation Matrix)

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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

Signature of the HOD

---- 23 - 886*	HEALTH & WELLNESS	L	T	P	C**
AUDIT		0	0	2	1

*(First four digits in the subject code is branch code and Seventh digit is Semester)

** Health & Wellness has one credit for the third semester only and it has no credits for other semesters.

Skill Areas:

Physical Fitness, Nutrition, Mental Health, Awareness on Drug addiction and its effects

Purpose:

The Health & Wellness course focuses on teaching the elements of physical, mental, emotional, social, intellectual, environmental well-being which are essential for overall development of an individual. The course also addresses the dangers of substance abuse and online risks to promote emotional and mental health.

Learning Outcomes:

Upon completion of the Health & Wellness course, students will be able to:

1. Demonstrate proficiency in sports training and physical fitness practices.
2. Improve their mental and emotional well-being, fostering a positive outlook on health and life.
3. Develop competence and commitment as professionals in the field of health and wellness.
4. Awareness on drug addiction and its ill effects

Focus:

During the conduct of the Health & Wellness course, the students will benefit from the following focus areas:

1. Stress Management.
2. Breaking Bad Habits.
3. Improving Interpersonal Relationships.
4. Building Physical Strength & Inner Strength.

Role of the Facilitator:

The faculty plays a crucial role in effectively engaging with students and guiding them towards achieving learning outcomes. Faculty participation involves the following areas:

1. **Mentorship & Motivation:** The Facilitator mentors students in wellness and self-discipline while inspiring a positive outlook on health. Faculty teach stress management, fitness, and daily well-being.
2. **Promoting a Safe and Inclusive Environment:** The facilitator ensures a safe, inclusive, and respectful learning environment for active student participation and benefit.
3. **Individualised Support and Monitoring Progress:** The facilitator plays a crucial role in providing personalized support, monitoring and guidance to students.

Guided Activities:

In this course, several general guided activities have been suggested to facilitate the achievement of desired learning outcomes. They are as follows:

1. Introduction to Holistic Well-being.
2. Holistic Wellness Program- Nurturing Body and Mind
3. Breaking Bad Habits Workshop.
4. Improving the elements of physical, emotional, social, intellectual, environmental and mental well-being.
5. Creating situational awareness, digital awareness.
6. Understanding substance abuse, consequences and the way out.

Period Distribution

The following are the guided activities suggested for this Audit course.

The Physical Director should plan the activities by the students.

Arrange the suitable Mentor / Guide for the wellness activities.

Additional activities and programs can be planned for Health and Wellness.

S.No	Guided Activities	Period
1	Introduction to Holistic Well-being 1. Introduce the core components of Health & Well-being namely Physical, mental and emotional well-being 2. Provide worksheets on all the four components individually and explain the interconnectedness to give an overall understanding.	
2	Wellness Wheel Exercise (Overall Analysis)	

	4. Brain Health Discuss the importance of brain health for daily life. Habits that affect brain health (irregular sleep, eating, screen time). Habits that help for healthy brains (reading, proper sleep, exercises). Benefits of breathing exercises and meditation for healthy lungs. 5. Healthy Lungs Discuss the importance of lung health for daily life. Habits that affect lung health (smoking, lack of exercises). Benefits of breathing exercises for healthy lungs. 6. Hygiene and Grooming Discuss the importance of hygienic habits for good oral, vision, hearing and skin health. Discuss the positive effects of grooming on one's confidence level and professional growth. <u>Suggested Activities (sample):</u> Nutrition: Invite a nutritionist to talk among the students on the importance of nutrition to the body or show similar videos shared by experts on social media. Organize a 'Stove less/fireless cooking competition' for students where they are expected to prepare a nutritious dish and explain the nutritive values in parallel.	
5	Emotional Well-being 1. Stress Management Trigger a conversation or provide self-reflective worksheets to identify the stress factors in daily life and their impact on students' performance. Introduce different relaxation techniques like deep breathing, progressive muscle relaxation, or guided imagery. (use audio recordings or visuals to guide them through these techniques). After practicing the techniques, have them reflect on how these methods can help manage stress in daily life. 2. Importance of saying 'NO'.	

	Explain the students that saying 'NO' is important for their Physical and mental well-being, Academic Performance, Growth and Future, Confidence, Self-respect, Strong and Healthy Relationships, building reputation for self and their family (avoid earning a bad name). Factors that prevent them from saying 'NO'. How to practice saying 'NO'. 3. Body Positivity and self-acceptance Discuss the following with the students. • What is body positivity and self-acceptance? • Why is it important? • Be kind to yourself. • Understand that everyone's unique. <u>Suggested Activities(Sample):</u> (Importance of saying 'NO') Provide worksheets to self-reflect on... ...how they feel when others say 'no' to them ...the situations where they should say 'no' Challenge students to write a song or rap about the importance of saying no and how to do it effectively. Students can perform their creations for the class.	
6	Social Well-Being 1. Practicing Gratitude Discuss the importance of practicing gratitude for building relationships with family, friends, relatives, mentors and colleagues. Discuss how one can show gratitude through words and deeds. Explain how practicing gratitude can create 'ripple effect'. 2. Cultivating Kindness and Compassion Define and differentiate between kindness and compassion. Explore practices that cultivate these positive emotions. Self-Compassion as the Foundation.	

	The power of small gestures. Understanding another's perspective. The fruits of compassion. 3. Practising Forgiveness Discuss the concept of forgiveness and its benefits. Forgiveness: What is it? and What it isn't? Benefits of forgiveness. Finding forgiveness practices. 4. Celebrating Differences Appreciate the value of individual differences and foster inclusivity. The World: A Tapestry of Differences (cultures, backgrounds, beliefs, abilities, and appearances). Finding strength in differences (diverse perspectives and experiences lead to better problem-solving and innovation). Celebrating differences, not ignoring them (respecting and appreciating the unique qualities). Activities for celebrating differences (share culture, learn about others, embrace new experiences). 5. Digital Detox Introduce the students to: The concept of a digital detox and its benefits for social well-being. How to disconnect from devices more often to strengthen real-world connections. <u>Suggested Activities (sample):</u> (Practicing Gratitude) Provide worksheets to choose the right ways to express gratitude. Celebrate 'gratitude day' in the college and encourage the students to honour the house keeping staff in some way to express gratitude for their service.	
7.	Intellectual Well-being 1. Being a lifelong Learner Give students an understanding on: The relevance of intellectual well-being in this 21st century to meet	

	the expectations in personal and professional well-being The Importance of enhancing problem-solving skills Cultivating habits to enhance the intellectual well-being (using the library extensively, participating in extra-curricular activities, reading newspaper etc.) 2. Digital Literacy Discuss: The key aspects of digital literacy and its importance in today's world. It is more than just liking and sharing on social media. The four major components of digital literacy (critical thinking, communication, problem-solving, digital citizenship). Why is digital literacy important? Boosting one's digital skills. 3. Transfer of Learning Connections between different subjects – How knowledge gained in one area can be applied to others. <u>Suggested Activities(sample):</u> Intellectual Well-being. Provide worksheets to students for teaching them how to boost intellectual well-being. Ask the students to identify a long-standing problem in their locality, and come up with a solution and present it in the classroom. Also organize an event like 'Idea Expo' to display the designs, ideas, and suggestions, to motivate the students to improve their intellectual well-being.	
8	Environmental Well-being 1.The Importance of initiating a change in the environment. The session could be around: Defining Environmental well-being (physical, chemical, biological, social, and psychosocial factors) – People's behaviour, crime, pollution, political activities, infra-structure, family situation etc. Suggesting different ways of initiating changes in the environment (taking responsibility, creating awareness, volunteering,	

	approaching administration). <u>Suggested Activities (sample):</u> Providing worksheets to self-reflect on how the environment affects their life, and the ways to initiate a change. Dedicate a bulletin board or wall space (or chart work) in the classroom for students to share their ideas for improving environmental well-being. Creating a volunteers' club in the college and carrying out monthly activities like campus cleaning, awareness campaigns against noise pollution, (loud speakers in public places), addressing anti-social behaviour on the campus or in their locality.	
9	Mental Well-being 1. Importance of self-reflection Discuss: Steps involved in achieving mental well-being (self-reflection, self-awareness, applying actions, achieving mental well-being). Different ways to achieve mental well-being (finding purpose, coping with stress, moral compass, connecting for a common cause). The role of journaling in mental well-being. 2. Mindfulness and Meditation Practices Benefits of practicing mindful habits and meditation for overall well-being. 1. Connecting with nature Practising to be in the present moment – Nature walk, feeling the sun, listening to the natural sounds. Exploring with intention – Hiking, gardening to observe the nature. Reflecting on the emotions, and feeling kindled by nature. 2. Serving people Identifying the needs of others. Helping others. Volunteering your time, skills and listening ear. Finding joy in giving. 3. Creative Expressions	

	Indulging in writing poems, stories, music making/listening, creating visual arts to connect with inner selves. <u>Suggested Activities(Sample):</u> (Mindfulness and Meditation) – Conducting guided meditation every day for 10 minutes and directing the students to record the changes they observe.	
10	Situational Awareness (Developing Life skills) 1. Being street smart Discuss: Who are street smart? Why is it important to be street smart? Characteristics of a street smart person: Importance of acquiring life skills to become street smart – (General First-aid procedure, CPR Procedure, Handling emergency situations like fire, flood etc). 2. Digital Awareness Discuss: Cyber Security Information Literacy Digital Privacy Fraud Detection <u>Suggested Activities</u> (sample): (Street Smart) Inviting professionals to demonstrate the CPR Procedure Conducting a quiz on Emergency Numbers	
11	Understanding Addiction Plan this session around: Identifying the environmental cues, triggers that lead to picking up this habit. Knowing the impact of substance abuse – Adverse health conditions, social isolation, ruined future, hidden financial loss and damaging the family reputation. Seeking help to get out of this addiction. <u>Suggested Activities:</u>	

	Provide Worksheets to check the students' level of understanding about substance addiction and their impacts. Share case studies with students from real-life. Play/share awareness videos on addiction/de-addiction, experts talk. *Conduct awareness programmes on Drugs and its ill effects. (Arrange Experts from the concerned government departments and NGOs working in drug addiction issues) and maintain the documents of the program.	
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Closure:

Each student should submit a Handwritten Summary of their Learnings & Action Plan for the future.

Assessments:

- Use Self-reflective worksheets to assess their understanding.
- Submit the worksheets to internal audit/external audit.
- Every student's activities report should be documented and the same have to be assessed by the Physical Director with the mentor. The evaluation should be for 100 marks. No examination is required.

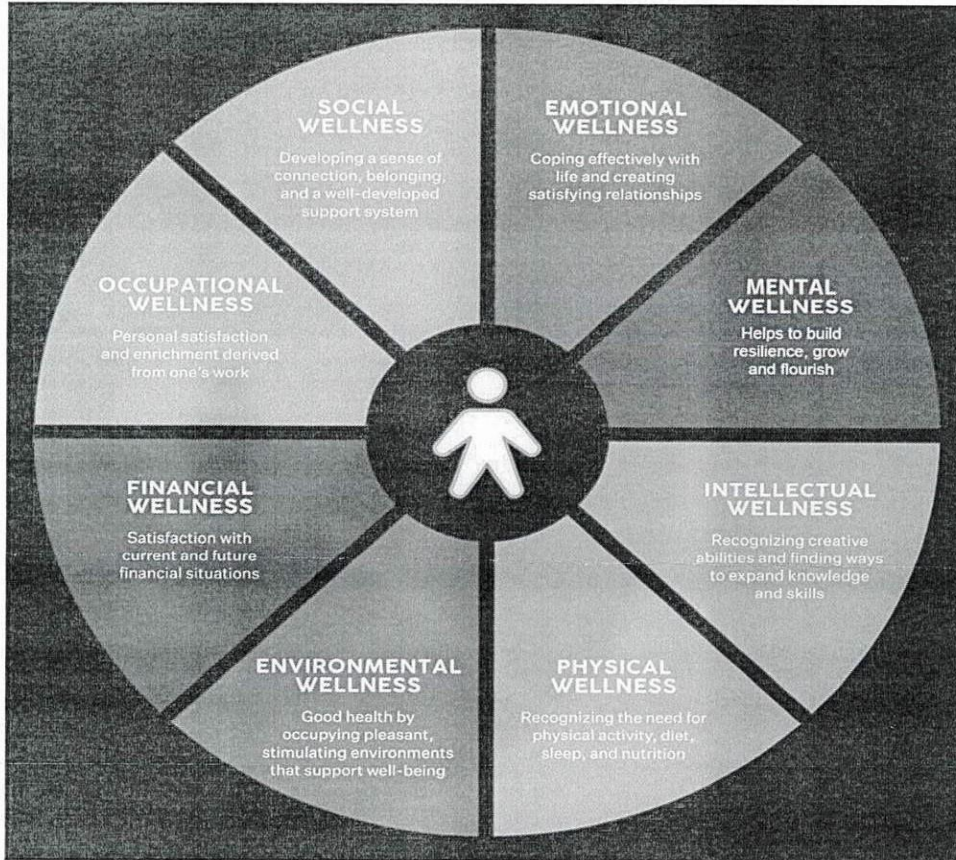
Scheme of Evaluation

Part	Description	Marks
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
Total		100

References/Resource Materials:

The course acknowledges that individual needs for references and resources may vary. However, here are some general reference materials and resources that may be helpful:

1. The Well-Being Wheel:



2. Facilities & Spaces: Some activities may require access to specific facilities, resources or spaces. Students may need to coordinate with the college administration to reserve these as required.

3. Online Resources:

1. United Nations Sustainable Development Goals - Goal 3 - Good Health & Well-Being: <https://www.un.org/sustainabledevelopment/health/>
2. Mindfulness and Meditation: Stanford Health Library offers mindfulness and meditation resources: <https://healthlibrary.stanford.edu/books-resources/mindfulness-meditation.html>

3. Breaking Bad Habits: James Clear provides a guide on how to build good habits and break bad ones: <https://jamesclear.com/habits>
4. 6 Ways to Keep Your Brain Sharp
<https://www.lorman.com/blog/post/how-to-keep-your-brain-sharp>
5. What Is Social Wellbeing? 12+ Activities for Social Wellness
<https://positivepsychology.com/social-wellbeing/>
6. How Does Your Environment Affect Your Mental Health?
<https://www.verywellmind.com/how-your-environment-affects-your-mental-health-5093687>
7. How to say no to others (and why you shouldn't feel guilty)
<https://www.betterup.com/blog/how-to-say-no>

Title of the Course	INTRODUCTION TO NCC (For NCC students only)						
Paper No.	NCC -I						
Category	NCC	Year	II	Credits	2	Course Code	B3NCC1
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	-		-		
Objectives of the course	• To acquaint cadets with the aims and objectives of NCC • To train Cadets to assist the civil administration in the performance of selective duties during disasters. • To develop an all-round dynamic personality with adequate leadership traits to deal/contribute effectively in all walks of life. • To teach cadets the values and skills involved in providing voluntary Social Service. • To know respect and responsibility towards personal health and hygiene.						
Course Outline	UNIT –I THE NCC, NATIONAL INTEGRATION AND AWARENESS: NCC - History, aim and Objectives- Organization and Training - Incentives of joining NCC, Duties of NCC Cadets, Types of NCC Camps. National Integration - Religions, Culture, Traditions and Customs of India, Importance and necessity of National Integration, Problems/ Challenges/Threats of National Integration, Unity in Diversity. Famous Leaders of India. Slogans for National Integration. Contribution of Youth to Nation Building and Role of NCC in Nation Building.						
	UNIT -II CIVIL AFFAIRS AND SOCIAL AWARENESS COMMUNITY DEVELOPMENT: Civil Defence Organization and its duties (NDMA, SDMA, DDMA, NDRF), Types of Natural Hazards- Role of NCC during Natural Hazards/ Calamities - Essential services Social Services – Basics and Needs of Social Service - Social awareness - Social Rural Development Projects. Contribution of youth towards social welfare, Civic responsibilities. Role of Youth in Corruption, dowry, female foeticide, Drug abuse and Causes and prevention of HIV/AIDS, NGOs and their contribution in social Welfare.						
	UNIT -III PERSONALITY DEVELOPMENT: Personality development – Introduction, Physical, Social, Psychological and Philosophical Factors influencing personality. Self-Awareness – know yourself Thinking- meaning and Concepts - Critical and creative thinking. Problem-solving skills - Interview skills - Importance of group and teamwork - Coping with stress/emotions - Characteristics of healthy personalities – ethics/values.						

	UNIT- IV HEALTH AND HYGIENE: Structure and functioning of the human body - Hygiene and sanitation (Personal and Food Hygiene) - Physical and mental health - Infectious and contagious diseases and its prevention- Basics of first aid in common medical emergencies - Wounds and fractures - Introduction to yoga (Purpose and benefits of Padmasana, Surya Namaskar, Vajrasana, Sarvangasana, Siddhasana). UNIT -V ENVIRONMENT AWARENESS AND CONSERVATION: Natural resources – conservation and management - Water conservation and rainwater harvesting - Waste management - Pollution – types and its control, water, air, noise, soil- Wildlife conservation: projects in India UNIT – VI CURRENT CONTOURS: (For Continuous Internal Assessment only): Students are allowed to practice Drill, word of command. Instruct the students to understand current affairs by reading leading newspapers REFERENCE: 1. Cadet Handbook (Common Subjects), published by DGNCC. 2. Cadet Handbook (Specialized Subjects), published by DGNCC. 3. https://modernschoolnagpur.edu.in/ncc-study-material/ 4. https://nccorissa.org/old/Doc/Ncc-CadetHandbook.pdf 5. https://indiancc.nic.in/anos-handbook/ 6. R Guptas NCC Army wing. Ramesh Publishing House, New Delhi, 2021.
COURSE LEARNING OUTCOME	After completion of this course, cadets will be able to • Understand aims and objectives of NCC • Understand the sense of patriotism and secular values • Contribute towards nation building through national unity and social cohesion. • Cadets would assist Civil Administration in the performance of selective duties during disasters • Develop personality with adequate leadership traits. • Understand the responsibility towards personal health and hygiene. • Sensitise the cadets on natural resource conservation and protection of the environment.

Title of the Course	GENERAL CHEMISTRY-IV						
Paper No.	CC7						
Category	Core	Year	II	Credits	5	Course Code	B4CH7
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	1	-		6		
Prerequisites	General Chemistry IV						
Objectives of the course	This course aims to provide comprehensive knowledge of - thermodynamic concepts on chemical processes and applied aspects. - thermochemical 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						
	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), relation between heat capacities (Cp & Cv); Joule Thomson effect- inversion temperature. Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels. 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 disorder. Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships. Third law of thermodynamics - Nernst heat theorem; Applications of the 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, color, magnetic properties, catalytic properties, and tendency to form complexes. Comparative study of transition elements and non-transition elements – comparison of the II and III transition series with the I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel, and Zinc groups
	UNIT IV: Aldehydes and Ketones Nomenclature, structure, and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base-catalysed reactions - 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 – Ponnord Verley reduction, reduction with LiAlH_4 and NaBH_4.
	UNIT V: Carboxylic Acids and their Derivatives Carboxylic Acids: Nomenclature, structure, preparation, and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Carboxylic acid Derivatives: Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of an acyl halide, anhydride, ester, or amide. Schotten-Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement.

Extended Professional Component (is a part of the 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. B.R. Puri and L.R. Sharma, <i>Principles of Physical Chemistry</i>, Shoban Lal Nagin Chand and Co., thirty-third edition, 1992. 2. K. L. Kapoor, <i>A Textbook of Physical chemistry</i>, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009. 3. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand & Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i>, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., third edition, 1994.
Reference Books	1. Maron, S.H. and Prutton C.P. <i>Principles of Physical Chemistry</i>, 4th ed.; The Macmillan Company: New York, 1972. 2. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4th ed.; ELBS William Heinemann: London, 1991. 3. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i>, 26th ed.; Goel Publishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. <i>Physical Chemistry</i>, 10th ed.; Oxford University Press: New York, 2014. 5. Huheey, J. E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, 4th ed; Addison Wesley Publishing Company: India, 1993.
Website and e-learning source	MOOC components https://nptel.ac.in/courses/112102255 Thermodynamics https://nptel.ac.in/courses/104101136 Advanced transition metal chemistry

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

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

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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**Signature of the HOD**

Title of the Course	GRAVIMETRIC QUANTITATIVE ESTIMATION						
Paper No.	CC8						
Category	Core	Year	II	Credits	3	Course Code	B4CH8P
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
		-	3		3		
Prerequisites							
Course Objectives							
• Understand the principles and techniques of gravimetric analysis. • Perform quantitative estimation of metal ions through precipitation and complex formation methods. • Calculate and interpret analytical results obtained from gravimetric estimations.							

Gravimetric Analysis

1. Estimation of calcium as calcium oxalate
2. Estimation of barium as barium sulphate
3. Estimation of barium as barium chromate
4. Estimation of lead as lead sulphate
5. Estimation of lead as lead chromate
6. Estimation of nickel as nickel dimethylglyoxime complex
7. Estimation of Mg as oxinate.

Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences
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Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO 1: Perform gravimetric analysis for the estimation of metal ions using suitable precipitation methods.

CO 2: Apply principles of solubility, precipitation, and complex formation in quantitative analysis.

CO 3: Calculate and interpret analytical results obtained from gravimetric estimation experiments.

	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

Level of Correlation between PSO's and CO's

Signature of the HOD

Title of the Course	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS						
Paper No.	SEC - 2						
Category	SEC	Year	II	Credits	2	Course Code	B4CHSE2
		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 • 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. Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors.						
	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.						
	UNIT III: Ultraviolet-Visible and Infrared Spectroscopy Basics: Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy - Beer-Lambert's law. UV-Visible Spectrometry: Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument. Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator& detector) for single and double beam instrument.						
	UNIT IV: Thermal Analysis TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate.						

	UNIT V Separation and purification techniques Classification, principle, Factors affecting - Solvent Extraction – Liquid - Liquid Extraction, Chromatography: Column, TLC and Paper- Principle, Classification, Choice of Adsorbents and Solvents. Cyclic voltammetry- Basic principles and applications
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. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman. 2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007 3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017). 4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993. 5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th edn., Prentice Hall of India Private Ltd., New Delhi, 1993
Reference Books	1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edn., Saunders college publishing, Philadelphia, 1998. 2. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011. 3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004. 4. Mikes, O. & Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Ellis Harwood Ltd. London 6. 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	1. http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf 2. http://eric.ed.gov/?id=EJ386287 3. http://www.sjsu.edu/faculty/watkins/diamag.htm 4. http://www.britannica.com/EBchecked/topic/108875/separation-and-purification 5. http://www.chemistry.co.nz/stoichiometry.htm
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course, the students should be able to: CO1: Apply error analysis and explain flame photometry and AAS techniques. CO2: Explain the theory and applications of UV-Visible and IR spectroscopy. CO3: Describe thermal and electrochemical techniques. CO4: Explain chromatographic methods for separation and identification. CO5: Perform solution preparation and 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-PO Mapping (Course Articulation Matrix)

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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

Signature of the HOD

Title of the Course	ARMY (for NCC students only)						
Paper No.	NCC- II						
Category	NCC	Year	II	Credits	2	Course Code	B4NCC2
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	-		-		
Objectives of the course	To acquaint cadets with the Armed Forces To provide knowledge of renowned Military Generals, PVCs and Indo-Pak Wars. To teach cadets elementary map reading To teach cadets elementary field craft and battle craft To introduce cadets to the latest trends in the field of communications						
Course Outline	UNIT- I ARMED FORCES: Basic organization of Armed Forces - Organization of the Army - Badges and Ranks - Honours and Awards - Modes of entry into Army -Fighting Arms - Supporting Arms and Services.						
	UNIT- II MAP READING: Introduction to types of Maps and conventional signs. -Scales and grid system - Topographical forms and technical terms - Relief, contours and gradients - Cardinal points and Types of North. Types of bearing- Use of service Protractor –Prismatic Compass – setting up of a Map, Finding north and own position.						
	UNIT- III F I E L D CRAFT AND BATTLE CRAFT: Introduction - Judging distance - Description of ground - Recognition, description and indication of land marks and targets - Observation, camouflage and concealment - Field signals - Use of ground and movement - Selection of formations - Knots and Lashing						
	UNIT -IV COMMUNICATION AND LEADERSHIP: Introduction – Types and Importance of communication - Means of communication - Modern methods of communication- radio telephony – Characteristics of Walkie talkie- The military alphabets in communication- Latest trends in communication – Leadership – types of leadership-Qualities of a leader – Leadership traits - Working in Teams & Groups. Case study – Swami Vivekananda, Rattan Tata, Rabindranath Tagore.						
	UNIT -V MILITARY HISTORY: Freedom Struggle and Nationalist Movement in India.Biographies of renowned generals (Carriappa/ Manekshaw)- Indian Army War Heroes -Study of battles of indo Pak war 1965, 1971 and Kargil. Role of NCC in 1965 War						

	UNIT –VI CURRENT CONTOURS: (For Continuous Internal Assessment only): Provide basic information on weapon and weapon training
	REFERENCE: Cadet Hand Book (Common Subjects), published by DGNCC. Cadet Hand Book (Specialized Subjects), published by DGNCC. https://modernschoolnagpur.edu.in/ncc-study-material/ https://nccorissa.org/old/Doc/Ncc-CadetHandbook.pdf https://indiancc.nic.in/anos-handbook/ R Guptas NCC Army wing. Ramesh Publishing House, New Delhi, 2021
COURSE LEARNING OUTCOME	After completion of this Course Cadets will be able to • Acquaint cadets with the Armed forces. • Understand the role of renowned Military Generals, PVCs and Indo-Pak Wars • Understand the process of map reading and conventional signs. • Understand elementary field craft and battle craft • Understand the latest trends in the field of communications • Understand leadership and its traits

Title of the Course	ORGANIC CHEMISTRY - I						
Paper No. CC9	CC9						
Category	Core	Year	III	Credits	5	Course Code	B5CH9
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	1	-		6		
Prerequisites	General Chemistry I,II, III and IV						
Objectives of the course	This course aims to provide an understanding of • stereoisomerism in chiral 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 color 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 centers, racemization- methods of racemization; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereo genic) centers. 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, physicalproperties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions and 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 and 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 amines. Diazonium compounds-Diazomethane, Benzene diazonium chloride - preparations and synthetic applications.
	UNIT IV: Heterocyclic compounds - I 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: Heterocyclic compounds -II 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 to be included in the external examination question paper) component only, Not	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. 3. ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition, 2012. 4.P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007. 5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.
Reference Books	1.R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012. 2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition, 2012.
	3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition, 2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.
Website and e-learning sources	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http://swayam.gov.in 4. Virtual Textbook of Organic Chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.

CO2: explain preparation and properties of aromatic and aliphatic nitro compounds and amines

CO3: explain colour and constitution of dyes and food additives

CO4: discuss preparation and properties of five-membered heterocycles like pyrrole, furan, and thiophene

CO5: discuss preparation and properties of six-membered heterocycles like pyridine, quinoline, and isoquinoline

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

CO-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
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

Signature of the HOD

Title of the Course	INORGANIC CHEMISTRY -I						
Paper No.	CC 10						
Category	Core	Year	III	Credits	5	Course Code	B5CH10
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	-	-		5		
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 coordination compounds with coordination 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.						
	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, interpretation of magnetic properties, spectra of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$. Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants- factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea). Comparison of VBT and CFT.						

	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, Color and spectra, 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 polyphosphonitrilic chloride), sulphur-based polymer (polysulfide and polymeric sulphur nitride), boron-based polymers (borazine polymers) – industrial application of inorganic polymers.
Extended Professional Component (is a part of internal to be included in the external examination question paper) component only,	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 Edition, Milestone Publishers & Distributors, Delhi. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd. 5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.
Reference Books	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed., S.Chand and Company, New Delhi. 2. Gopalan R, (2009) <u>Inorganic Chemistry for Undergraduates</u>, 1st Edition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) <u>Inorganic Chemistry</u>, 1st Edition, Pearson, Chennai 4. Alan G. Sharp (1992), <u>Inorganic Chemistry</u>, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http://swayam.gov.in
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: explain isomerism, Werner's Theory and stability of chelate complexes CO2: discuss crystal field theory, magnetic properties and spectral properties of complexes. CO3: explain preparation and properties of metal carbonyls CO4: give a comparative account of the characteristics of lanthanoids and actinoids CO5: explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous	

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

CO-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
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

Signature of the HOD

Title of the Course	PHYSICAL CHEMISTRY -I						
Paper No.	CC 11						
Category	Core	Year	III	Credits	5	Course Code	B5CH11
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	1	-		6		
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: Solutions Raoult's law, Hendry's Law,Ideal solution and non-ideal solutions, concentration units.Activity and activity co-efficients. colligative properties -experimental method of osmotic pressure – Measurement of osmotic pressure, relative lowering of vapour pressure,elevation of boilin point and depression of freezing point(no derivation). applications in calculating -Abnormal molecular mass, degree of dissociation and associated solutes in solution.						
	UNIT II: Chemical Kinetics Rate of reaction - 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. significance of entropy and free energy of activation. Comparison of collision theory and ARRT.						

	UNIT III: Surface Chemistry Adsorption – Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations, kinetics. Catalysis – general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogeneous, heterogeneous catalysis. Enzyme catalysis. Michaelis–Menten Equation.
	UNIT IV: Colloids Types of Colloids, Characteristics of 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 and 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 photochemistry- Lambert-Beer Law, Grothus-Draper law and Stark-Einstein's law of photochemical equivalence. Quantum yield and its explanation – Photophysical processes: Jablonski diagram – Fluorescence – Phosphorescence. Non-radiative processes: Internal conversion and intersystem crossing. Photosensitization – Chemiluminescence – Photochemical reactions -H₂-Cl₂, H₂-Br₂ and H₂ – I₂.
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. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.
Reference Books	1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013. 2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009. 5. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001.
Website and e-learning source	1. https://nptel.ac.in 2. https://swayam.gov.in 3. www.epgpathshala.nic.in
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: explain Gibbs and Helmholtz free energy functions, partial molar quantities and 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-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
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

Signature of the HOD

Title of the Course	PHYSICAL CHEMISTRY PRACTICAL						
Paper No.	CC12						
Category	Core	Year	II	Credits	3	Course Code	B5CH12P
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	3		3		
Prerequisites	Physical Chemistry						
Objectives of the course	The course aims at providing an understanding of - the laboratory experiments in order to understand the concepts of physical changes in chemistry - the rates of chemical reactions - colligative properties and adsorption isotherm						
Course Outline	I. Distribution law: a. Partition coefficient of Iodine between carbon tetra chloride and water b. Equilibrium constant of the reactions. $I_2 + I^- \rightarrow I_3^-$ II Kinetics: Acid catalyzed hydrolysis of an ester (Methyl acetate or Ethyl acetate) III. Molecular weight: Rast's method: Naphthalene, m-dinitrobenzene and diphenyl as solvents. IV. Heterogeneous equilibrium: a. Critical solution temperature of phenol-water system-effect of impurity on C.S.T. (2% NaCl or 2 % succinic acid solutions). b. Simple eutectic system: Naphthalene – Biphenyl, Naphthalene, Diphenylamine. c. Determination of transition temperature: Sodium acetate.H₂O, Na₂S₂O₃.5H₂O, SrCl₂.6H₂O & MnCl₂.4H₂O. V. Electrochemistry: Conductivity: Cell constant Equivalent conductivity Conductometric titrations Potentiometry Potentiometric titrations.						
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.						

Reference Books	1. Sindhu, P.S. <i>Practicals in Physical Chemistry</i> , Macmillan India : New Delhi, 2005. 2. Khosla, B. D. Garg, V. C.; Gulati, A.; <i>Senior Practical Physical Chemistry</i> , R. Chand : New Delhi, 2011. 3. Gupta, Renu, <i>Practical Physical Chemistry</i> , 1 st Ed.; New Age International: New Delhi, 2017.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: describe the principles and methodology for the practical work CO2: explain the procedure, data and methodology for the practical work. CO3: apply the principles of 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-PO Mapping (Course Articulation Matrix)

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	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

Signature of the HOD

Title of the Course	INDUSTRIAL CHEMISTRY						
Paper No.	EC1						
Category	Elective	Year	III	Credits	4	Course Code	B5CHEC1
		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 is designed to provide knowledge on • classifications and characteristics of fuels • preparation of cosmetics • manufacture of sugar, paper, cement, 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, carbonization of coal. Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number. Gaseous fuel: water gas, producer gas, carbureted water gas - preparations - uses. Natural gas: LPG-composition, advantages, application; gobar gas- production, composition, advantages and application.						
	UNIT II: 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; soap less detergents- anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents						
	UNIT III: Sugar and Paper Industries Sugar Industry Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar. Paper Industry Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, coloring, calendaring; cardboard.						
	UNIT IV: Leather Industry Structure of skin: Anatomical Structure of Hide and Skin, Chemical Structure of Hide and Skin. Types of Tanning: Chrome Tanning, Vegetable Tanning, and Combination Tanning. Pre-Tanning process: soaking, lining, delining, baking, drenching. Degrading and pickling. Leather Finishing.						

	UNIT V: 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 Glass: Types – composition -manufacture of optical glass, colored glass and neutron absorbing glass.
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. Sharma, B.K. <i>Industrial Chemistry</i>, 9th ed.; Goel Publishing House: Meerut, 1998. 2. Wilkinson, J.B.E. Moore, R.J. <i>Harry's Cosmeticology</i>, 7th ed.; Chemical Publishers : New York, 1982. 3. Alex V. Ramani, <i>Food Chemistry</i>, MJP publishers: Chennai, 2009. 4. Jayashree Ghosh, <i>Applied Chemistry</i>, S. Chand : New Delhi, 2006. 5. Srilakshmi, B. <i>Food Science</i>, 4th ed.; New Age International Publication, 2005.
Reference Books	1. Jain, P.C.; Jain, M. <i>Engineering Chemistry</i>, 16th ed.; Dhanapet Rai: Delhi, 1992 2. George Howard, <i>Principles and Practice of Perfumes and Cosmetics</i>, Stanley Therones, Cheltenham: UK, 1987. 3. Thankamma Jacob, <i>Foods, Drugs and Cosmetics - A Consumer Guide</i>, Macmillan : London, 1997. 4. Shankuntala Manay, N.; Shadaksharaswamy, M. <i>Food Facts and Principles</i>, 3rd ed.; New Age Publication, 2008. 5. Neeraj Pandey, Khushdeep Dharni, <i>Intellectual Property Rights</i>, PHI Learning, 2014.
Website and e-learning source	1. http://www.sciencecases.org/irradiation/irradiation_notes.asp 2. http://discovery.kcpc.usyd.edu.au/9.5.5/ 3. https://www.wipo.int/about-ip/en/ 4. www.nptel.ac.in 5. http://swayam.gov.in

	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 /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

Signature of the HOD

Title of the Course	FOOD CHEMISTRY						
Paper No.	SEC - 3						
Category	SEC	Year	I	Credits	2	Course Code	B5CHSE3
		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.						
	UNIT II: Food Poison Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) -Chemical poisons - First aid for poison consumed victims.						
	UNIT III: Food Additives Food additives -artificial sweeteners – Saccharin - Cyclamate and Aspartate – Food colours– Emulsifying agents – preservatives -leavening agents. Baking powder –Yeast – tastemakers – MSG - vinegar.						
	UNIT IV: Beverages Beverages-softdrinks-soda-fruitjuices-alcoholicbeverages-examples. Carbonation-addiction to alcohol– diseases of liver and social.problems.						
	UNIT-V: Edible Oils Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases-definition of iodine value, RM value, saponification values and their significance.						

Recommended Text	1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. 2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co. Publishers, second edition, 2006. 3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. 4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022. 5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Padmini S Ghugre, New age international publishers, second edition, 2021.
Reference Books	1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4th Edition, 2009. 2. M. Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979. 3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008. 4. Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009. 5. Principles of food chemistry, John M. de Man, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.
Website and e-learning source	1. https://nptel.ac.in 2. https://swayam.gov.in 3. 4. https://www.fao.org/food-safety/en/
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter. CO 2: get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion CO 3: get an exposure on food additives, artificial sweeteners, Saccharin, Cyclamate and Aspartate in the food industries. CO 4: acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples. CO 5: study about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA	

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

Signature of the HOD

Credits : 2 **Hours/Week** : 2
Medium of Instruction : English / Tamil **Code** : **B5DM**

இளநிலை பட்ட வகுப்பு - பகுதி - IV

(2026 - 2027 ஆம் கல்வியாண்டு முதல் சேர்க்கப்பட்ட மாணவர்களுக்குரியது)

ஐந்தாம் பருவம்

DISASTER MANAGEMENT (பேரிடர் மேலாண்மை)

Course Description

Disasters pose serious threats to human life, property, infrastructure, and the environment. Increasing urbanization, climate change, environmental degradation, and technological developments have intensified disaster risks across the world. This course introduces students to the concepts of disaster risk reduction and management, enabling them to understand disaster risks, adopt preparedness measures, and contribute to building resilient communities. The course also familiarizes students with disaster governance in Tamil Nadu and highlights the importance of community participation, environmental sustainability, and responsible citizenship in reducing disaster risks.

Course Objectives

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

1. Understand the concepts and significance of disaster risk reduction and management.
2. Identify different types of natural and human-induced disasters.
3. Understand disaster preparedness, mitigation, response, and recovery measures.
4. Recognize the role of individuals, communities, and institutions in disaster management.
5. Develop awareness and skills for disaster preparedness and resilience.

UNIT I – Fundamentals of Disaster Risk Reduction

Disaster: Meaning and Characteristics - Hazard, Risk, Vulnerability and Capacity - Disaster Risk Reduction (DRR): Concept and Importance - Disaster Management Cycle: Prevention – Mitigation – Preparedness – Response – Recovery – Rehabilitation - Community Resilience.

UNIT II – Types of Disasters

Natural Disasters: Earthquakes – Floods – Cyclones – Tsunami – Drought – Landslides - Heat Waves and Lightning - Sea-Level Rise - Human-induced Disasters: Fire Accidents - Industrial and Chemical Disasters - Biological Emergencies and Pandemics - Air Crashes, Road and Rail Accidents - Environmental Pollution.

UNIT III – Disaster Preparedness and Emergency Response

Early Warning Systems - Disaster Preparedness at Home, School and Workplace - Emergency Kits - Evacuation Procedures - First Aid Awareness - Search and Rescue Basics - Fire Safety - Relief and Rehabilitation - Psychological Support during Disasters

UNIT IV – Disaster Governance in India

Disaster Management Act, 2005 - National Disaster Management Authority (NDMA) - National Disaster Response Force (NDRF) - State and District Disaster Management Authorities - Role of Local Bodies - NGOs - Sendai Framework for Disaster Risk Reduction

- Sustainable Development Goals (SDG) and Disaster Resilience.

UNIT V – Building Disaster-Resilient Communities

Disaster Resilience: Concept and Importance - Community-Based Disaster Risk Reduction (CBDRR) - Disaster Risk Reduction in Educational Institutions - Role of Volunteers and Civil Society - Best Practices in Disaster Risk Reduction: Selected Case Studies from India - Odisha Cyclone Preparedness Model, 2004 Indian Ocean Tsunami, COVID-19 Pandemic.

Practical / Experiential Learning (NON-EXAMINATION COMPONENT)

Students shall undertake **any one** of the following:

- Preparation of a Family Disaster Preparedness Plan.
- Campus Hazard Mapping.
- Awareness Campaign on Disaster Preparedness.
- Preparation of an Emergency Survival Kit.
- Participation in a Mock Drill.
- Visit to Fire and Rescue Services or District Disaster Management Office.
- Case Study of a Major Disaster in India.

Course Outcomes (COs)

After completing the course, students will be able to:

CO1: Explain the basic concepts and principles of disaster risk reduction and management.

CO2: Identify various natural and anthropogenic disasters and assess their impacts.

CO3: Demonstrate awareness of disaster preparedness, emergency response, and safety measures.

CO4: Describe the institutional framework for disaster management in India.

CO5: Promote disaster-resilient practices in families, educational institutions, and communities.

Text Books

1. Subramanian, R. *Disaster Management*. New Delhi: Vikas Publishing House, 2018.
2. S.C. Sharma, *Disaster Management*, New Delhi: Khanna Publishing House, 2019.
3. D.B.N. Murthy, *Disaster Management Text and Case Studies*, New Delhi: Deep & Deep Publications, 2008.
4. Shrivastava, A.K. *Text book of Disaster Management*, Jodhpur: Scientific Publishers, 2020.
5. Rajendra K. Pandey, *Disaster Management in India: Policies, Institutions, Practices*, New York: Routledge, 2023.

References

1. Alexander, David. *Principles of Emergency Planning and Management*. Oxford University Press, 2002.
2. Carter, W. Nick. *Disaster Management: A Disaster Manager's Handbook*. Asian Development Bank, Manila, 2008.
3. Coppola, Damon P. *Introduction to International Disaster Management*. 4th ed., Butterworth-Heinemann/Elsevier, 2020.
4. Government of India. *The Disaster Management Act, 2005*, New Delhi: Government of India.
5. National Disaster Management Authority (NDMA). *National Disaster Management Plan*, New Delhi: Government of India, 2019.
6. National Institute of Disaster Management (NIDM). *Training Designs and Modules on Disaster Risk Reduction*, Government of India.
7. Tamil Nadu State Disaster Management Authority, *District Disaster Management Plan – 2024, Thanjavur District*.

8. United Nations Development Programme (UNDP). *Reducing Disaster Risk: A Challenge for Development*.
9. United Nations Office for Disaster Risk Reduction (UNDRR). *Sendai Framework for Disaster Risk Reduction 2015–2030*.
10. Wisner, Ben, Piers Blaikie, Terry Cannon, and Ian Davis. *At Risk: Natural Hazards, People's Vulnerability and Disasters*. 2nd ed., Routledge, 2003.
11. World Bank. *Building Resilient Communities: Risk Management and Response to Natural Disasters*.

Online Resources

1. India Meteorological Department (IMD)
2. Indian National Centre for Ocean Information Services (INCOIS)
3. National Disaster Management Authority (NDMA)
4. National Disaster Response Force (NDRF)
5. National Institute of Disaster Management (NIDM)
6. Tamil Nadu State Disaster Management Authority (TNSDMA)
7. TNSDMA Digital Library
8. United Nations Office for Disaster Risk Reduction (UNDRR)

CO–PO Mapping Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	2	1	–	1
CO2	3	3	1	3	1	–	1
CO3	2	3	2	3	2	2	2
CO4	2	2	2	2	3	3	1
CO5	2	3	2	3	3	3	3

Question Paper Pattern

Maximum Marks : 50

Exam Duration : 3 Hours

Part A - 5 x 10 = 50 (5 Out of 8, atleast One Question from each Unit)

Title of the Course	ORGANIC CHEMISTRY - II						
Paper No.	CC13						
Category	Core	Year	III	Credits	5	Course Code	B6CH13
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	1	-		6		
Prerequisites	Organic Chemistry – I						
Objectives of the course	This course aims to provide knowledge on • classification, isolation, and discussion of the properties of alkaloids and terpenes • preparation and properties of saccharides • biomolecules • different molecular rearrangements • preparation and properties of organometallic compounds						
Course Outline	UNIT I: Alkaloids and Terpenes Alkaloids: Classification, isolation, general properties - Structural elucidation – Coniine and piperine. Terpenes: Classification, Isoprene rule, isolation and structural elucidation of alpha terpineol, Menthol, Geraniol and Nerol.						
	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. Muta rotation. Monosaccharides – configuration – D and L hexoses – aldohexoses and ketohexoses. Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses. Disaccharides – sucrose, maltose - preparation, properties a n d uses (no structural elucidation). Polysaccharides – Source, constituents and biological importance of homopolysaccharides- starch and cellulose.						
	UNIT III: Molecular rearrangements Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasi en, Fries, Hofmann, Curtius, Schmidt, Pinacole pinacolone, Beckmann rearrangement, Wagner–Meerwein Rearrangement and dienone – phenol rearrangement.						

	UNIT IV: Organometallic Compounds in Organic Synthesis Principle, preparations, properties and applications of Group I and II metal organic compounds Li, Hg and Zn compounds. Transition metals, Ni, Fe, Cu, and Cr compounds. Preparation, Properties and application of Grignard Reagents, Organo Lithium Compounds, Ziegler–Natta, Wilkinson, Metal Carbonyl, Zeiss’s Salt.
	UNIT V: Green Chemistry Twelve 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 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, 4th reprint,2009. 2 S.M. Mukherji, and S.P. Singh, Reaction Mechanism in OrganicChemistry, Macmillan IndiaLtd., 3rd edition,2009 3 Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition,2012. 4 P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry,Sultan Chand & Sons, New Delhi, 29th edition, 2007. 5 C Bandyopadhyaya; An Insight into Green Chemistry; Published on 2020
Reference books	1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia,6th edition, 2012. 2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons,11th edition, 2012. 3. A.Carey Francis,OrganicChemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi,7th edition,2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, 6th edition, 2006. 6 J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5thEdition, 2010.
Website and e-learning source	1. www.nptel.ac.in 2. http://swayam.gov.in 3. Virtual Textbook of Organic Chemistry 4. 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-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
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

Signature of the HOD

Title of the Course	INORGANIC CHEMISTRY –II						
Paper No.	CC14						
Category	Core	Year	III	Credits	5	Course Code	B6CH14
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	1	-		6		
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 Ferritin; Iron-porphyrins – myoglobin, hemoglobin – oxygen transport - Bohr effect; Sodium/potassium 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), pyro silicates (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.
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. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand and Company Ltd. 5. A. K. De, Textbook of Inorganic Chemistry, Wiley-East Ltd, seventh edition, 1992
Reference Books	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded., S.Chand and Company, New Delhi. 2. Gopalan R, (2009) <u>Inorganic Chemistry for Undergraduates</u>, Ist Edition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) <u>Inorganic Chemistry</u>. Ist Edition, Pearson, Chennai 4. Alan G. Sharp (1992), <u>Inorganic Chemistry</u>, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http://swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)										
On completion of the course the students should be able to										
CO1: ability to explain the importance of tracer elements on biological system.										
CO2: explain the metal ion transport, Bohr effect, Na, K, Ca pump.										
CO3: explain the function of Vitamin 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-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
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

Signature of the HOD

Title of the Course	PREPARATION OF ORGANIC AND INORGANIC COMPOUNDS						
Paper No.	CC 15						
Category	Core	Year	III	Credits	3	Course Code	B6CH15P
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
		-	3		3		
Prerequisites	Theoretical knowledge on inorganic and organic compounds						
Objectives of the course	This course aims at providing • Preparation of Inorganic compounds. • Hands on experience in carrying out the experiments • Preparation of organic compounds						
Course Outline	UNIT I: Preparation of Inorganic Compounds- Potash alum Tetraammine copper (II) sulphate. Hexammine cobalt (III) chloride Mohr's Salt.						
	UNIT II: Preparation of Organic Compounds 1. Nitration-picric acid from Phenol 2. Halogenation-p-bromo acetanilide from acetanilide 3. Oxidation-benzoic acid from Benzaldehyde 4. Microwave assisted reactions in water: 5. Methyl benzoate to Benzoic acid 6. Salicylic acid from Methyl Salicylate 7. Rearrangement-Benzil to Benzilic Acid 8. Hydrolysis of benzamide to Benzoic Acid						
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: assess the yield of different in organic preparations and identify the end point of various titrations. CO2: Explain the procedure, data and methodology for the practical work CO3: Apply the principles of inorganic chemistry for carrying out the practical work CO4: Demonstrate laboratory skills for safe handling of the equipment and chemicals							

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	3	2	3	2	3	2	3
CO2	3	2	3	2	3	2	3	3	2	2
CO3	2	3	3	3	2	3	2	3	3	2
CO4	3	2	3	3	3	2	3	2	3	2
CO5	2	3	2	3	3	3	2	3	2	3

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 PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Signature of the HOD

Title of the Course	PHYSICAL CHEMISTRY-II						
Paper No.	EC2						
Category	Core	Year	III	Credits	5	Course Code	B6CHEC2
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	1	-		6		
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 electrochemical series.						
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).						
	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 –Le Chatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clapeyron equation – Clausius Clayperon 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; Debye-Hückel theory –						

	Onsager equation (no derivation), significance of Onsager equation, Debye-Falkenhagen effect, Wien effect. 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.
	UNIT V: Galvanic Cells and Applications Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell. 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, insoluble salt/anion, gas electrode, redox electrode; electrochemical series. Applications of EMF Measurements Applications of EMF measurements – determination of activity coefficient of electrolytes, valency of ions, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations – acid-base titrations, redox titrations.
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. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.

Reference Books	1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009. 2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalandhar, forty first, edition, 2001 5. D.N. Bajpai, Advanced Physical Chemistry, S.Chand & Co., 2001
Website and e-learning source	1. https://nptel.ac.in https://swayam.gov.in 2. https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf 3. Thermodynamics - NPTEL https://www.youtube.com/watch?v=f0udxGcoztE 4. Introduction to chemical equilibrium – MIT open course 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-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
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

Signature of the HOD

Title of the Course	FUNDAMENTALS OF SPECTROSCOPY						
Paper No.	SEC4						
Category	Elective Course	Year Semester	III VI	Credits	2	Course Code	B6CHSE4
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 • 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: 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 – Birge Sponer 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.						
	UNIT III: Infrared Spectroscopy Selection rules, vibrations of polyatomic molecules – stretching and bending vibrations – applications-determination of force constant, moment of inertia and internuclear distance-isotopic shift-applications of IR spectra to simple organic and inorganic molecules (group frequencies)						
	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 de shielding of protons, chemical shifts of protons in hydrocarbons and in simple monofunctional organic compounds.						
	UNIT V: Mass spectrometry Principle – different kinds of ionization – instrumentation – the mass spectrum – types of ions – determination of molecular formula- fragmentation and structural elucidation – McLafferty rearrangement; Retro Diels Alder reaction.						

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	1. Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. <i>Elements of Analytical Chemistry</i>; S Chand: New Delhi, 2003. 2. Usharani, S. <i>Analytical Chemistry</i>, 1sted.; Macmillan: India, 2002. 3. Banwell, C.N.; Mc Cash, E. M. <i>Fundamentals of Molecular Spectroscopy</i>, 4th ed.; Tata McGraw Hill, New Delhi, 2017. 4. U.N.Dash, <i>Analytical Chemistry Theory and Practice</i>, Sultan Chand & Sons, 2nd Ed., 2005 5. B.K.Sharma, <i>Spectroscopy</i>, 22nd ed., Goel Publishing House, 2011.
Reference Books	1. Srivastava, A. K.; Jain, P. C. <i>Chemical Analysis an Instrumental Approach</i>, 3rded.; S.Chand, New Delhi, 1997. 2. Robert D Braun. <i>Introduction to Instrumental Analysis</i>; Mc.Graw Hill: New York, 1987. 3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. <i>Fundamentals of Analytical Chemistry</i>, 9thed.; Harcourt college Publishers: USA, 2013. 4. Madan, R. L.; Tuli, G. D. <i>Physical Chemistry</i>, 2nded.; S.Chand: New Delhi, 2005. 5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. <i>Principles of Physical Chemistry</i>, 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 3. www.epgpathshala.nic.in 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: 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	PO 10
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 /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

Signature of the HOD

Credits : 2 Hours/Week : 2
Medium of Instruction : English / Tamil Code: B6GS

இளநிலை பட்ட வகுப்பு - பகுதி - IV

(2026 - 2027 ஆம் கல்வியாண்டு முதல் சேர்க்கப்பட்ட மாணவர்களுக்குரியது)

ஆறாம் பருவம்

பாலினக் கல்வி (Gender Studies)

Course Objectives

1. To make boys and girls aware of each other strengths and Weakness.
2. To develop sensitivity towards both genders in order to lead an ethically enriched life.
3. To promote attitudinal change towards a gender balanced ambience and womenempowerment.

அலகு - 1

பாலினம் தொடர்பான கோட்பாடுகள்: பாலியல் - பாலினம் - உடற்கூறு ரீதியாக நிர்ணயித்தல் - ஆணாதிக்கம் - பெண்ணியம் - பாலின பாகுபாடு — பாலின வேலைப்பாகுபாடு — பாலின ஒருபடித்தானவைகள் - பாலின உணர்வூட்டல் - பாலின சமவாய்ப்பு — பாலின சமத்துவம் - பாலினமையநீரோட்டமாக்கல் - அதிகாரப்படுத்துதல்.

அலகு - 2

மகளிரியல் Vs பாலின சமத்துவக் கல்வி- பல்கலைக்கழக மானியக்குழுவின் வழிகாட்டுதல்கள் - ஏழாவது ஐந்தாண்டுத் திட்டம் முதல் பதினோராவது ஐந்தாண்டுத் திட்டம் - பாலின சமத்துவக்கல்வி: பெய்ஜிங் மாநாடு மற்றும் பெண்களுக்கு எதிரான அனைத்து வன்முறைகளையும் ஒழிப்பதற்கான சர்வதேச உடன்படிக்கை - இணைத்தல் / உட்படுத்துதல் - ஒதுக்கல்.

அலகு - 3

பாலியல் பாகுபாட்டிற்கான தளங்கள்: குடும்பம் - பாலின விகிதாச்சாரம் - கல்வி - ஆரோக்கியம் - ஆளுமை - மதம் - வேலை Vs வேலைவாய்ப்பு - சந்தை - ஊடகங்கள் - அரசியல் - சட்டம் - குடும்ப வன்முறை - பாலியல் துன்புறுத்தல் - அரசு கொள்கைகள் மற்றும் திட்டங்கள்.

அலகு - 4

பெண்கள் மேம்பாடு மற்றும் பாலின சமத்துவ மேம்பாடு: முயற்சிகள் - சர்வதேச பெண்களுக்கான தசாப்தம் - சர்வதேச பெண்கள் ஆண்டு - பெண்களின் மேம்பாட்டிற்கான தேசிய கொள்கை - பெண்கள் அதிகார ஆண்டு 2001 - சர்வதேச கொள்கைகளை மைய நீரோட்டமாக்கல்.

அலகு - 5

பெண்கள் இயக்கங்கள் மற்றும் பாதுகாப்பு நிறுவன ஏற்பாடுகள்: தேசிய மற்றும் மாநில மகளிர் ஆணையம் - அனைத்து மகளிர் காவல் நிலையங்கள் - குடும்ப நீதிமன்றங்கள் - குடும்ப வன்முறையிலிருந்து பெண்களைப் பாதுகாக்கும் சட்டம் 2005 - பணியிடங்களில் பெண்கள் மீதானபாலியல் துன்புறுத்தல்களை தடுப்பதற்கான உச்ச நீதிமன்ற வழிகாட்டுதல்கள் - தாய்சேய் சேமநலச் சட்டம் பெண் சிசுவை கருவிலேயே கண்டறியும் தொழில் நுட்பம் (முறைப்படுத்துதல் மற்றும் தவறாக பயன்படுத்துதலை தடைசெய்திடும்) சட்டம் - ஈவ்ஃசிங் (பெண்களை தொல்லை செய்தல்) தடுப்புச் சட்டம் - சுய உதவிக் குழுக்கள் - பஞ்சாயத்து அமைப்புகளுக்கான 73வது மற்றும் 74வது சட்டத்திருத்தம்.

REFERENCE BOOKS

1. Saha Chandana, Gender Equity and Gender Equality: Study of Girl Child in Rajasthan, Jaipur: Rawat Publication, 2003
2. Misra Geetanjali, Chandiramani Radhika (ed.,) Sexuality, Gender and Rights: Exploring Theory and Practice in South and Southeast Asia, New Delhi : Sage Publication, 2005
3. Krishna Sumi, (ed.,), Livelihood and Gender: Equity in Community Resource Management, New Delhi : Sage Publication, 2004
4. Sexual Harassment at the Workplace – A Guide , New Delhi ;Sakshi, 1999

Course Outcomes		Cognitive level
At the end of the course, the students will be able to		
CO-1	Understand the problems of gender bias in the society	Understanding
CO-2	Know and Recollect the legal safety measures available to protect from the gender discrimination	Remembering
CO-3	Analyse the ways in which social institutions and power structures impact the material realities of women's lives	Remembering
CO-4	Demonstrate an openness to learn the views from the view of a women	Applying
CO-5	Develop equitable and just thinking towards women	Applying

Question Paper Pattern

Maximum Marks : 75

Exam Duration : 3 Hours

Part A - 5 x 6 = 30 (5 Out of 7 atleast 1 Question from each Unit)

Part B - 3 x 15 = 45 (3 Out of 5 - 1 Question from each Unit)

Title of the Course	CHEMISTRY I (FOR MATHEMATICS, ZOOLOGY, BIOCHEMISTRY AND PHYSICS)						
Paper No.							
Category	Allied	Year	I	Credits	4	Course Code	B1GCH1/ B3GCH1
		Semester	I/III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	-			4		
Prerequisites	Higher secondary chemistry						
Objectives of the course	This course aims to provide knowledge on the • To acquire the knowledge of Acids and bases, buffer action • To learn about Polar Effects, Halogen-containing Compounds and Types of Solvents • To study the various concepts of Aromatic Compounds, Organic Reactions and Chemotherapy. • To get knowledge about Solid State, Energetic and Phase Rule. • To learn about Chemical Equilibrium, Chemical Kinetics and Catalysis.						
Course Outline	UNIT I: Acids and Bases Arrhenius concept and limitations-Bronsted- lowry concept-conjugate acid and conjugate base -limitations– Lewis concept-examples of lewis acids and bases. Strength of acids and bases – strength of aliphatic acids-solvent that influence the strength of acids and bases - Defintion of pH pOH and Pka– buffer solutions.						
	UNIT II: Polar Effects Inductive effect- Relative strength of aliphatic monocarboxylic acid and aliphatic amines. - Resonance- conditions for resonance, consequences of resonance- resonance energy. Basic property of aniline and acidic property of phenol - Hyper conjugation - consequences of hyperconjugation- Heat of hydrogenation, bond length and dipolemoment. Steric effect – steric accelerated reaction and steric inhibited reaction.						
	UNIT III: Aromatic Compounds and Chemotherapy Structure, stability, resonance and aromaticity of benzene -Typical substitution reaction- i) Nitration ii) Halogenation iii) alkylation. (iv) acylation. (v) sulphonation Chemotherapy: Explanations with two examples each for i) Analgesics ii) Antibacterial iii) Anti- inflammatory, iv) Antipyretic , v) Antibiotic. (Structures not necessary).						

	UNIT IV: Solid State and Phase Rule Solid State: Typical crystal lattices – unit cell. Elements of symmetry. Bragg's equation, Weiss indices, Miller indices, simple, body centered and face centered cubes – Crystal defects. Phase Rule: Phase, component, degrees of freedom, and phase rule definition. One component – water system. Reduced phase rule - two components – Pb-Ag system.
	UNIT V: Kinetics Chemical Equilibrium: Criteria of homogeneous and heterogeneous equilibria. Decomposition of HI, N₂O₄ and PCl₅ Chemical Kinetics: Definitions-Order and molecularity of reactions. Activation energy, Effect of temperature on reaction rate. Catalysis: Definition and examples: Positive and negative catalyst, homo and heterogeneous catalysis, autocatalysis and enzyme catalysis.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 3. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, NewDelhi, twenty third edition, 2012. 4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference books	1. P.L.Soni,MohanKatyal,Textbook of Inorganicchemistry;SultanChand and Company,New Delhi, twentieth edition, 2007. 2. B.R.Puri,L.R.Sharma,M.S.Pathania, TextbookPhysicalChemistry;VishalPublishingCo., New Delhi, fortyfourth edition, 2018. 3.B.K,Sharma, IndustrialChemistry;GOELpublishinghouse,Meerut,16th edition, 2014.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Apply the principles of kinetics in calculating reaction rates, activation energies, and order of reactions

CO2: Understand and appreciate the importance of phase rule and its applications and energetic

CO3: Understand the utility of organic reactions and appreciate the structure-activity relationship of certain drugs

CO4: Determine the rate law of chemical change based on experimental data

CO5: Understand the concept of kinetics and catalysts

	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 PO's and CO's

Signature of the HOD

Title of the Course	CHEMISTRY - II (FOR MATHEMATICS, ZOOLOGY, BIOCHEMISTRY AND PHYSICS)						
Paper No.							
Category	Allied	Year	I	Credits	4	Course Code	B2GCH2/ B4GCH2
		Semester	II/IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	-	-		4		
Prerequisites	Chemistry for physical sciences -I						
Objectives of the course	This course aims at providing knowledge on the • To learn about Coordination Chemistry, Metallic Bond, Compounds of Sulphur in inorganic compounds. • To acquire the knowledge of Carbohydrates, Amino Acids and Proteins, • To study the various concepts and applications of Synthetic Polymers, Heterocyclic Compounds and Stereoisomerism. • To understand the various ideas of colloids and photochemistry. • To learn about the Electrochemistry.						
Course Outline	UNIT I: Coordination Chemistry Nomenclature of mononuclear complexes – Werner, Sidgwick, and Pauling’s theories. Chelation and its industrial importance to EDTA. Biological role of hemoglobin and chlorophyll. Unit II: Carbohydrates and Amino acids Carbohydrates: Classification- glucose and fructose- preparation and properties of glucose- configuration of glucose. Sucrose, starch and cellulose – properties and uses. Amino Acids and Proteins: Amino acids- classification based on structure and essential and non- essential amino acids (preparation only) – peptides (elementary treatment) - proteins- Structures of proteins-primary and secondary. UNIT III: Polymers and Heterocyclic Compounds Synthetic Polymers: Teflon, alkyl and epoxy resins, poly esters-general treatment - preparation, properties and uses. Heterocyclic Compounds: Furan, thiophen, pyrrole and pyridine – preparation, properties and uses. Relative basic strength of pyridine and pyrrole.						
	UNIT IV: Colloids and Photochemistry Colloids: Emulsions, gels- preparation, properties and applications. Electrophoresis, chromatography- column, paper and thin layer chromatography Photochemistry: Laws of photochemistry - lambert’s law, lambert-beer law, Grothuss–Draper Law, Einstein law of photochemical equivalence- photo synthesis- photoelectric effect.						

	UNIT V: Electrochemistry Specific conductance, equivalent conductance and their determination using Kohlrausch bridge – effect of dilution on conductivity. An elementary idea about ionic theory- Ostwald's dilution law, Kohlrausch law, conductometric titrations (weak acid vs strong base only). pH determination using Hydrogen electrode and glass electrode.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; SultanChand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; SultanChand and Company, New Delhi, twentieth edition, 2007. 2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 3. B.K,Sharma, Industrial Chemistry; GOEL, publishing, house, sixteenth edition, 2014.
Website and e-learning source	1. https://nptel.ac.in 2. https://chem.libretexts.org 3. https://swayam.gov.in

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: Be able to preparation and properties of glucose

CO 3: Have acquired knowledge of Synthetic Polymers, preparation and properties of Heterocyclic Compounds and stereoisomerism.

CO4: Have acquired knowledge of photochemistry and colloids

CO 5: Have knowledge of Electrochemistry.

	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	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

Signature of the HOD

Title of the Course	CHEMISTRY PRACTICAL						
Paper No.							
Category	Allied	Year Semester	I/ II II/IV	Credits	4	Course Code	B2GCH2P/ B4GCH2P
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	3		3		
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 • identification of organic functional groups • determination of elements in organic compounds.						
Course Outline	VOLUMETRIC ANALYSIS 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate. 5. Estimation of potassium permanganate using standard sodium hydroxide. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using diphenyl amine as indicator.						
	ORGANIC ANALYSIS A study of the reactions of the following organic compounds 1. Carbohydrate 2. Amide 3. Aldehyde 4. Ketone 5. Acid 6. Amine 7. Phenol The students may be trained to perform the specific reactions like tests for elements (nitrogen only), aliphatic or aromatic, saturated or unsaturated and functional group present and record their observations.						

Reference Books	V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO 2: design, carry out, record and interpret the results of volumetric titration. CO 3: apply their skill in the analysis of water/hardness. CO4: analyze the chemical constituents in allied chemical products CO5: Know the various types of functional groups	

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

CO-PO Mapping (Course Articulation Matrix)

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

Signature of the HOD

**NON MAJAOR ELECTIVE
(FOR OTHER DEPARTMENTS)**

Title of the Course	CHEMISTRY AND SOCIETY						
Paper No.	NMEC-I						
Category	NMEC-1	Year	III	Credits	2	Course Code	B5CHNMEC1
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	3	-	-		3		
Prerequisites	Higher secondary chemistry						
Objectives of the course	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						
Course Outline	UNIT I: Air and Water Air: components and their importance; air pollution, the greenhouse effect, and the impact on our lifestyle. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness, water pollution.						
	UNIT II: Materials Building materials - cement, ceramics, and glass - definition, composition and application. Plastics - polythene, PVC, Bakelite, polyesters, preparation and uses.						
	UNIT III: Food, Nutrition and Household Chemistry Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories, minerals and vitamins (sources and their physiological importance). Household Products - toothpaste, face powder, soaps and detergents - general formulation and preparations - possible hazards of cosmetic use.						
	UNIT IV: Agricultural Chemistry and Energy Sources Fertilizers- fertilizers and their need - natural sources: urea and super phosphate. Fuel – classification: solid, liquid and gaseous; nuclear fuel examples and uses.						

	UNIT V: Pharmaceutical and Industrial Chemistry Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.
Recommended Text	1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. 2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012. 3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 4. 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. 5. 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, fourth edition, 1977. 2. W.A. Poucher, Joseph A. Brink, Jr. Perfumes, Cosmetics and Soaps, Springer, 2000. 3. A.K. De, Environmental Chemistry, New Age International Public Co., 1990.
Website and e-learning source	1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7044178/ 2. https://byjus.com/question-answer/name-the-element-which-is-important-component-of-ceramics-glass-and-cement-csialca-1/ 3. https://kids.britannica.com/students/article/food-and-nutrition/274373 4. https://study.com/academy/lesson/pharmaceutical-drugs-definition-types.html
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	M	S	M	S	M	S	M
CO2	S	M	S	S	M	S	S	M	M	S
CO3	S	S	M	S	S	M	S	S	M	M
CO4	M	S	S	M	S	S	S	M	S	M
CO5	S	S	M	S	M	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	2	3
CO3	3	3	3	3	3
CO4	3	3	2	3	3
CO5	3	3	3	3	2
Weightage	15	15	14	14	14
Weighted Percentage of Course Contribution to POs	3.0	3.0	2.8	2.8	2.8

Level of Correlation between PO's and CO's

Signature of the HOD

Title of the Course	APPLIED INDUSTRIAL CHEMISTRY						
Paper No.	NMEC-2						
Category	NMEC	Year	III	Credits	2	Course Code	B6CHNMEC2
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	3	-	-		3		
Prerequisites	Higher secondary chemistry						
Objectives of the course	• Understand the types, properties, and uses of industrial fuels. • Explain water quality, hardness, and industrial water treatment methods. • Describe the manufacturing processes of sugar, matches, and explosives. • Understand renewable energy sources, especially solar and wind energy. • Identify industrial wastes and their treatment and disposal methods.						
Course Outline	UNIT I: Industrial fuels Classification of fuels: solid, liquid, and gas. Calorific value of fuels and its determination. Solid fuels – Coal types – properties and uses – lignite, sub-bituminous coal, bituminous coal and anthracite. Liquid fuels: Refining of crude petroleum and uses of fractions. Gaseous fuels: Natural gas and gobar gas: production, composition and uses.						
	UNIT II: Water treatment Introduction: Sources of water. Hardness of water. Disadvantages of hard water in the industry: Estimation of hardness – EDTA method. Water softening methods: industrial purpose, Lime–soda process, and Zeolite process. Removal of suspended impurities. Removal of microorganisms – Chlorination, Reverse osmosis, Desalination.						
	UNIT III: Industries Sugar Industry: Manufacture of sugar from molasses and beetroot – sugar industries in India. Match industries: Manufacture – chemistry of lighting and pyrotechnics. Explosives: Definition – Classification – Characteristics of explosives – Nitrocellulose, T.N.T. and Picric acid.						
	UNIT IV: Energy Resources Renewable and non-renewable sources of energy, solar energy, solar technology, solar photovoltaic cell – application. Wind energy: Nature of the wind – power in the wind – factors influencing wind, applications. Wind energy potential in India.						

	UNIT V: Industrial Wastes Treatment Industrial Wastes and Treatment Processes, characteristics of industrial wastes, types of industrial wastes, solid industrial wastes, waste reduction process. Treatment and disposal of industrial wastes-mention of the general methods adopted for the treatment of industrial wastes, sanitary chemical analysis of industrial effluents, and sewage.
Reference Books	• Jain, P. C., & Jain, M. – <i>Engineering Chemistry</i>, Dhanpat Rai Publications. • B. K. Sharma – <i>Industrial Chemistry</i>, Goel Publishing House. • Shashi Chawla – <i>Engineering Chemistry</i>, Dhanpat Rai Publications. • Puri, Sharma & Pathania – <i>Principles of Physical Chemistry</i>, Vishal Publishing Co. (for fuel and energy concepts). • S. S. Dara & S. S. Umare – <i>A Textbook of Engineering Chemistry</i>, S. Chand Publishing.
Website and e-learning source	https://nptel.ac.in https://swayam.gov.in https://ndl.iitkgp.ac.in
Course Learning Outcomes (CLOs) At the end of the course, students will be able to: CLO1: Explain the classification, properties, and applications of industrial fuels and determine their calorific values. CLO2: Describe the causes of water hardness and apply suitable industrial water treatment and purification methods. CLO3: Explain the manufacturing processes and chemical principles of the sugar, match, and explosive industries. CLO4: Analyze renewable and non-renewable energy resources, particularly solar and wind energy technologies and their applications. CLO5: Evaluate the characteristics, treatment, and disposal methods of industrial wastes and industrial effluents for environmental protection.	

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

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	2	3	3
CO4	3	3	3	2	3
CO5	3	3	3	3	2
Weightage	15	15	14	14	14
Weighted Percentage of Course Contribution to POs	3.0	3.0	2.8	2.8	2.8

Level of Correlation between PO's and CO's

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