

Modern, Multidisciplinary Chemistry Curriculum

Explore a dynamic blend of core chemistry, environmental science, digital tools, and the richness of Indian Knowledge Systems (IKS) – empowering students for global scientific challenges.

Skill-Based Learning with Real-World Relevance

From titration to spectroscopy, our hands-on labs and project-based learning equip students with the tools and techniques used in today's scientific research and Industries.

Sustainability and Scientific Ethics at the Core

Our program nurtures a deep sense of responsibility through green chemistry, environmental science, and ethical research courses, shaping the next generation of conscious chemists.

Vision:

"To be a leading institution in chemical education and research; grounded in Indian values, fostering innovation, and preparing chemists for global challenges."

Mission:

1. **Educational Excellence:** Deliver accessible, high-quality chemistry education incorporating modern advancements.
2. **Innovative Research:** Advance chemical sciences through pioneering research, equipping students for future success.
3. **Ethical Sustainability:** Promote ethical practices and a commitment to sustainable, environmentally responsible chemistry.
4. **Indian Knowledge Systems (IKS):** Integrate Indian knowledge systems and cultural values into the curriculum, fostering a deep connection to Indian heritage in chemical education and research.

A Bachelor of Science degree aims to develop students' skills in critical thinking, problem-solving, scientific inquiry, data analysis, and communication. The specific program outcomes include the following:

Programme Outcomes (PO) for B.Sc. (Hons) in science:

1. Knowledge Acquisition: Graduates will possess a solid understanding of fundamental scientific concepts and stay updated with advancements.
2. Application of Knowledge: Graduates will adeptly apply scientific knowledge to solve real-world problems and conduct effective experiments.
3. Analytical Skills: Graduates will develop strong analytical skills to interpret complex data and make informed decisions.
4. Laboratory Skills: Graduates will acquire advanced laboratory skills for safe, ethical experimentation and accurate data analysis.
5. Inquisitive Nature: Graduates will cultivate curiosity and a lifelong engagement with scientific inquiry.
6. Meta-cognition: Graduates will reflect on and improve their learning processes and problem-solving strategies.
7. Lateral Thinking: Graduates will enhance their ability to approach problems creatively and generate innovative solutions.
8. Communication Skills: Graduates will communicate scientific concepts clearly and effectively to diverse audiences.
9. Collaboration: Graduates will work effectively in teams, respecting diverse viewpoints and leveraging collective expertise.
10. Ethical and Social Aspects: Graduates will uphold ethical principles in science and understand the social and environmental implications of their work.

These concise Programme Outcomes ensure that B.Sc. (Hons) Science graduates are equipped with essential knowledge, skills, and values for their careers and societal contributions.

Programme-Specific Outcomes for B.Sc Chemistry

Programme Specific Outcomes (PSOs) are defined goals that specify what a student is expected to know and be able to do by the end of a specific academic program. PSOs are tailored to the particular field of study, focusing on the specialized knowledge, skills, and competencies that graduates should acquire in that program.

The PSOs aim to ensure students are well-prepared for professional careers, advanced studies, or research in their field. They complement the broader Programme Outcomes (POs), which cover general skills and competencies applicable across various disciplines.

Programme Specific Outcomes (PSOs) for B.Sc. in Chemistry

1. **Fundamental Chemical Knowledge:** Graduates will have a comprehensive understanding of core chemistry concepts, including organic, inorganic, physical, and analytical chemistry.
2. **Chemical Analysis and Synthesis:** Graduates will be proficient in performing qualitative and quantitative chemical analyses, as well as synthesizing chemical compounds.
3. **Laboratory Techniques:** Graduates will master essential laboratory techniques, including titration, chromatography, spectroscopy, and electrochemical methods.
4. **Chemical Safety and Ethics:** Graduates will demonstrate knowledge of chemical safety protocols and ethical considerations in chemical research and practice.
5. **Problem-Solving in Chemistry:** Graduates will apply chemical principles to solve theoretical and practical problems, designing experiments to test hypotheses.
6. **Chemical Research Skills:** Graduates will be capable of conducting independent chemical research, including literature review, experimental design, data collection, and analysis.
7. **Chemical Instrumentation:** Graduates will be skilled in using modern chemical instrumentation and software for data analysis and interpretation.
8. **Environmental and Green Chemistry:** Graduates will understand the principles of environmental and green chemistry, and apply them to minimize the environmental impact of chemical processes.
9. **Interdisciplinary Application:** Graduates will integrate knowledge from physics, biology, and mathematics to enhance their understanding and application of chemistry.
10. **Communication in Chemistry:** Graduates will effectively communicate chemical information through written reports, oral presentations, and scientific publications.
11. **Teamwork in Chemical Projects:** Graduates will collaborate effectively in multidisciplinary teams to achieve common goals in chemical research and industry.
12. **Lifelong Learning in Chemistry:** Graduates will engage in lifelong learning to stay abreast of advancements in chemistry and related fields.

PSO – PO Articulation Matrix

PSO / PO	Knowledge Acquisition	Application of Knowledge	Analytical Skills	Laboratory Skills	Inquisitive Nature	Meta-cognition	Lateral Thinking	Communication Skills	Collaboration	Ethical and Social Aspects
<i>Fundamental Chemical Knowledge</i>	S	M	M	L	L	L	L	M	L	M
<i>Chemical Analysis and Synthesis</i>	M	S	S	S	M	L	M	M	M	M
<i>Laboratory Techniques</i>	L	M	M	S	L	L	L	L	M	M
<i>Chemical Safety and Ethics</i>	M	M	L	S	L	L	L	M	L	S
<i>Problem-Solving in Chemistry</i>	M	S	S	M	M	M	S	M	M	M
<i>Chemical Research Skills</i>	M	S	S	S	S	M	M	S	M	M
<i>Chemical Instrumentation</i>	M	S	S	S	M	L	L	M	M	M
<i>Environmental and Green Chemistry</i>	M	M	M	M	M	M	M	M	M	S
<i>Interdisciplinary Application</i>	S	S	S	M	M	M	S	M	M	M
<i>Communication in Chemistry</i>	M	M	M	L	L	M	M	S	M	M
<i>Teamwork in Chemical Projects</i>	L	M	M	M	M	M	M	M	S	M
<i>Lifelong Learning in Chemistry</i>	S	M	M	M	S	S	M	M	M	M

This matrix uses "L" for low support, "M" for moderate support, "S" for strong support, and "NA" for not applicable, providing a clear visual representation of the alignment between the Programme Specific Outcomes and the Programme Outcomes.

Semester	Subject type	Subject Code	Title of the paper	Credit	IA	EA	Total
I	Multidisciplinary	CLTS231T10	Tamil – I	3	40	60	100
	Ability Enhancement	CLES231T20	English I	3	40	60	100
	Major	BCHF231T30	Principles of Chemistry – I	5	40	60	100
	Minor	BCHF231T40	Applied Physics-I	4	40	60	100
	Value added	ICSF231T80	Indian culture	1	100	-	100
	Value added	BCHF231T50	Principles of Environmental Science	2	40	60	100
	Skill Enhancement	BCHF231P60	Major Practical – I	2	40	60	100
	Skill Enhancement	BCHF231P70	Applied Physics Lab-I	2	40	60	100
				22			
II	Multidisciplinary	CLTS232T10	Tamil – II	3	40	60	100
	Ability Enhancement	CLES232T20	English II	3	40	60	100
	Major	BCHF232T30	Principles of Chemistry – II	5	40	60	100
	Minor	BCHF232T40	Applied Physics-II	4	40	60	100
	Value added	BCHF232T40	Cyber security	1	100	-	100
	Value added	BCHF232T60	Computer for Chemist	2	40	60	100
	Skill Enhancement	BCHF232P70	Major Practical – II	2	40	60	100
	Skill Enhancement	BCHF232P80	Applied Physics-II	2	40	60	100
				22			
III	Multidisciplinary	CLTS233T10	Tamil – III	3	40	60	100
	Ability Enhancement	CLES233T20	English- III	3	40	60	100
	Major	BCHF233T30	General Chemistry-I	5	40	60	100
	Minor	BCHF233T4B	Allied Mathematics-I / Allied Comp.Science-I	4 /3	40	60	100
	Skill Enhancement	BCHF233P60	Major Lab-III Qualitative Inorganic Analysis	2	40	60	100
	Skill Enhancement	BCHF233P70	Allied Computer science Lab-I	1	40	60	100
	Value Added	ICSF233T80	Yoga	1	100	-	100
	Value Added	BCHF233T50	Introduction to IKS -I	2	40	60	100
					22		
IV	Multidisciplinary	CLTS234T10	Tamil – IV	3	40	60	100
	Ability Enhancement	CLES234T20	English- IV	3	40	60	100
	Major	BCHF234T30	General Chemistry-II	5	40	60	100
	Minor	BCHF234T4B	Allied Mathematics-II / Allied Comp.Science-II	4 /3	40	60	100
	Skill Enhancement	BCHF234P50	Major Lab-IV Organic and Gravimetric Analysis	2	40	60	100
	Skill Enhancement	BCHF234P70	Allied Computer science Lab-II	1	40	60	100
	Value Added	BCCHF234I80	Indian Constitution	1	100	-	100
	Value Added	BCHF234T60	Indian Knowledge system: Rasasastra	2	40	60	100
				22			

V	Major		Inorganic Chemistry-I	5	40	60	100
	Major		Organic Chemistry-I	5	40	60	100
	Major		Physical Chemistry-I	5	40	60	100
	Major		Analytical Chemistry-I	5	40	60	100
	Major Elective		Pharmaceutical Chemistry	4	40	60	100
			Green Chemistry				
Skill Enhancement		Major Lab – V – Physical Chemistry Lab	2	40	60	100	
			26				
VI	Major		Inorganic Chemistry-II	5	40	60	100
	Major		Organic Chemistry-II	5	40	60	100
	Major		Physical Chemistry-II	5	40	60	100
	Major		Analytical Chemistry-II	5	40	60	100
	Major Elective		Polymer Chemistry	4	40	60	100
			Environmental Chemistry				
Skill Enhancement		Review Project	2	100	-	-	
			26				

Semester-I

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	CLTS231T10	Tamil -I	3	-	1	3

COURSE OUTCOMES:

CO	CO Statement
CO -1	பக்திஇலக்கியங்கள்வழிபக்திநெறிகளைஉணர்ந்துகொள்ளுதல்
CO -2	புதுக்கவிதையின்மூலம்வாழ்வியல்விழுமியங்களைஉணர்ந்துகொள்ளுதல்
CO -3	இலக்கணமும்மொழித்திறனும்மொழியையிழையின்றிப்பேசஎழுதகற்கத்தேவையானதமிழ்இலக்கணத்தி ன்இன்றியமையாமையைஉணர்ந்துகொள்ளுதல்
CO -4	மாணவர்களின்வாசிப்புதிறனையும்படைப்புத்திறனையும்மேம்படுத்தசமூகப்பிரச்சனைகளைஅறிந்துகொ ள்ளுதல்
CO-5	மொழினைபிழையின்றிகற்பதற்கும்பிறதுறைச்சார்ந்தகலைச்சொற்களையும்அறிந்துகொள்ளுதல்

முதல்பருவம் - பாடத்திட்டம்

அலகு :-1பக்திஇலக்கியம்

காஞ்சிமகாபெரியவர் - தெய்வத்தின்குரல்அறிமுகம் - விநாயகர் - தத்துவமயமானவிநாயகர் - பக்தி-
பக்திசெய்வதுஎதற்காக - ஸ்ரீராமன் - அம்மா- குருபரம்பரை- சரணாகதியேமுக்கியம் -
மஹான்கள்காட்டும்குருபக்தி- எழுத்துப்பணியில்விநாயகர்துணை - சைவசமயம் -
திருக்குறிப்புத்தொண்டநாயனார் - சாக்கியநாயனார் - ஜயடிகள்காடவர்கோன்நாயனார் - வைணவசமயம் -
பொய்கையாழ்வார் - சாக்தம் - காஞ்சிகாமாட்சிஅம்மன் - ஆதிசங்கரரும்காமாட்சிஅம்மனும்

அலகு: 2. இக்காலஇலக்கியம்

தமிழ்த்தாய்வாழ்த்து- மனோன்மணியம்சுந்தரனார்-போகின்றபாரதமும்வருகின்றபாரதம் -
பாரதியார்வருகின்றபாரதத்தைவாழ்த்துதல்தமிழின்இனிமை- பாரதிதாசன்ஒருகிராமத்துநதி-
சிற்பிபாலசுப்ரமணியம்இஅனுபவம்-கண்ணதாசன்காடு - பழனிபாரதி-
சென்னிமலைகிளியோபாத்ராஈரோடுதமிழன்பன்- தொழில்பாடல்கள் - கொண்டாட்டப்பாடல்கள் -
வழிபாட்டுபாடல்கள்

அலகு- 3 . இலக்கணம்

எழுத்தின்விளக்கம் - எழுத்தின்வகைகள் - வினாஎழுத்துக்கள்- சுட்டெழுத்துக்கள் - வல்லினம்மிகும்இடங்கள் -
வல்லினம்மிகாஇடங்கள் - ஒலிப்புமாறுபாடுகளும்பொருள்வேறுபாடுகளும் .

அலகு-4: சிறுகதைமற்றும்நாவல்

செவ்வாழை- அறிஞர் அண்ணா குலத்தங்கரை அரசமரம்- வ.வே.சுஜயர் அகலிகை- புதுமைப்பித்தன்தனிமை -
ராஜம்கிருஷ்ணன்யாருக்காக அழுதான் ஜெயகாந்தன்

அலகு - 5: மொழிப்பயிற்சி

பொருந்திய சொல்லைத் தேர்வு செய்தல் மரபுத்தொடர்நேர் காணல்கலைச் சொல்பிறமொழிச் சொற்களை நீக்கி எழுதுதல்
பாடநூல் :-

1. தெய்வத்தின்குரல் தொகுப்பாசிரியர் ராகணபதிவானதிபதிப்பகம் சென்னை -17
2. பாரதியார்கவிதைகள் 2007 எட்டாம் பதிப்பு தென் ல்நிலையம்
3. சுசக்திவேல் நாட்டுப்புறவியல் ஆய்வுமணிவாசகர்பதிப்பகம் சிதம்பரம்
4. ராவள்ளிக்கண்ணன் 1999 புதுக்கவிதையில் தோற்றமும் வளர்ச்சியும் நான்காம் பதிப்பு அகரம் வெளியீடு கும்பகோணம்
5. தமிழர் நாட்டுப்பாடல்கள் நியூ செஞ்சுரி புத்தகநிறுவனம்.

பார்வைநூல் :-

1. வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு நியூ செஞ்சுரி புக் ஹவுஸ் சென்னை
2. நாட்டுப்புறவியல் ஆய்வுவானமாமலை
3. சுசக்திவேல் மணிவாசகர்பதிப்பகம் பாரிமுனை சென்னை 108
4. சிற்பிபாலசுப்ரமணியம் இருபதாம் நூற்றாண்டு தமிழ்கவிதைகள்
5. பாரதிதாசன்பாடல்கள் பாவைப் பிளிகேஷன்ஸ் சென்னை
6. அற இலக்கியத்தில் வாழ்வியல் விழுமியங்கள் செம்முதாய்பதிப்பகம் சென்னை

CO-PSO Articulation Matrix:

Course Outcome (CO)	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO-1 (பக்திஇலக்கியம்)	3	2	2	1	1	1	2	1	1	1	1	1
CO-2 (இக்காலஇலக்கியம்)	3	3	2	1	1	1	2	1	1	1	1	1
CO-3 (இலக்கணம்)	3	2	3	1	1	1	2	1	1	1	1	1
CO-4 (சிறுகதை மற்றும் நாவல்)	2	2	2	1	1	1	2	1	1	1	1	1
CO-5 (மொழிப்பயிற்சி)	3	2	2	2	1	1	2	1	1	1	1	1

Possible Levels of Testing Based on Bloom's Taxonomy Levels:

Unit	Remember (K1)	Understand (K2)	Apply (K3)	Analyze (K4)	Evaluate (K5)	Create (K6)
பக்திஇலக்கியம்	✓	✓	✓			
இக்காலஇலக்கியம்	✓	✓	✓	✓		
இலக்கணம்	✓	✓	✓	✓		
.சிறுகதை மற்றும் நாவல்	✓	✓	✓	✓		
மொழிப்பயிற்சி	✓	✓	✓	✓		

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	CLES231T20	English –I	3	-	1	3

Objectives:

- To get inspiration from the life history of great scientists
- To get exposed to the genre of poetry
- To provide students with basic grammar of English
- To understand grammatically correct sentences and make use of it
- To groom the students to become a successful personality

Course Outcome:

Students will be able to:

CO1: Read and interpret the text in English language

CO2: Appreciate the poetic language.

CO3: Comprehend the Basic English grammar and its usage.

CO4: Write sentences without errors.

CO5: Develop an integrated sense of personal identity, a positive sense of self, and a personal code of ethics.

UnitI:Biography

1. Sir C.V. Raman
2. Srinivasa Ramanujan
3. APJ. Abdul Kalam

UnitII: Poetry

1. Edgar Allan Poe : Sonnet –To Science
2. Walt Whitman : When I heard the Learn'd Astronomer
3. Rudyard Kipling : The Secret of machine

UnitIII:Basic Grammar - I

1. Articles
2. Pronouns–Personal&Impersonal
3. Adjectives
4. Synonyms&Antonyms
5. SentenceStructure

Unit IV: Basic Grammar - II

1. Tense forms
2. Idioms & Phrases
3. Suitability & Verbs
4. E-Mail
5. Patterns of Greeting

Unit V: Personality Development

1. Know your personality
2. Leadership qualities
3. Enhance your effectiveness
4. Career planning
5. Time management

Text Books:

1. Aggarwala, N.K. A Senior English Grammar and Composition. Chennai: Goyal Brothers Prakashan, 2014.
2. Rajiv K. Mishra. *Personality Development*. Delhi: Rupa Publications, 2004

Reference Books:

1. <https://igniteindiaeducation.com/biography-of-dr-a-p-j-abdul-kalam/>
2. <https://www.britannica.com/biography/C-V-Raman>
3. <https://www.britannica.com/biography/Srinivasa-Ramanujan>
4. Kurant, Wendy. *Becoming America: An Exploration of American Literature from Precolonial to Post-Revolution*. Georgia: University of North Georgia Press, 2019.

CO- PSO Articulation Matrix

Course Outcome (CO)	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	1	1	2	1	1	2	2	3	2	3

CO2	1	1	1	1	1	1	1	1	3	2	1	2
CO3	3	2	2	1	2	2	2	2	2	3	2	3
CO4	3	2	2	1	2	2	2	2	2	3	2	3
CO5	2	1	1	3	3	2	2	3	3	3	3	3

Possible Levels of Testing based on Bloom's Taxonomy:

Unit	Remember (K1)	Understand (K2)	Apply (K3)	Analyze (K4)	Evaluate (K5)	Create (K6)
Biography	✓	✓				
Poetry	✓	✓		✓		
Basic Grammar - I	✓	✓	✓			
Basic Grammar - II	✓	✓	✓	✓		
Personality Development		✓	✓	✓		✓

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	BCHF231T30	Principles of Chemistry – I	4	0	1	5

Objectives

- Understand the quantum mechanical model of the atom and the periodic trends in atomic and ionic properties.
- Comprehend the nature of ionic and covalent bonds and predict molecular shapes using bonding theories.
- Explore covalent bonding, hybridization, and electronic effects in organic molecules and their impact on reactivity.
- Study the preparation, properties, and reaction mechanisms of alkanes, cycloalkanes, and aromatic hydrocarbons.
- Understand the behavior of gases, including molecular velocities, transport properties, and real gas equations.

Outcome

CO1: Explain the significance of quantum numbers and their role in determining electron configurations.

CO2: Predict molecular shapes and structures using VSEPR, VB, and MO theories.

CO3: Illustrate covalent bonding and hybridization in organic molecules with examples.

CO4: Describe the preparation and properties of alkanes, cycloalkanes, and aromatic hydrocarbons.

CO5: Explain the types of molecular velocities and their significance in the gaseous state.

Unit I: Electron occupancy and periodic properties

(15 hrs)

Electron Occupancy Quantum numbers - Principal, azimuthal, magnetic and spin Quantum numbers - their significance governing the occupancy of electrons- Aufbau Principle- Hund's rule -Pauli's exclusion principle, (n+1) rule, stability of half-filled and fully filled orbitals-Classification as s, p, d & f block elements, variation of atomic volume, atomic and ionic radii, ionisation potential, electron affinity, and electro negativity along periods and groups – Variation of metallic characters - Factors influencing the periodic properties.

Unit II: Chemical Bonding

(15 hrs)

Ionic bond - Lattice Energy - Born - Haber Cycle - Pauling and Muliken's Scales of electro negativity - Polarizing power and Polarisability - partial ionic character from electro negativity - Transitions from ionic to

covalent character and vice versa - Fajan's rule. Theories of Bonding-Shapes of simple inorganic molecules based on VSEPR theory (BeCl_2 , SiCl_4 , PCl_5 , SF_6 , IF_7 , NH_3 , XeF_6 , BF_3 , H_2O) - VB Theory - Principles of hybridization - a structure of BeCl_2 , NH_3 , H_2O - Basics of MO Theory - Bonding and antibonding orbitals - Application of MO Theory to H_2 , He_2 , N_2 , O_2 , HF and CO - Comparison of VB and MO Theories - H - bonding-types.

Unit III: Bonding in Organic Molecules

(15 hrs)

Covalent Bonding: Catenation- Concept of Hybridization-Types of hybridization- sp^3 , sp^2 , and sp - Examples - CH_4 , C_2H_4 and C_2H_2 bonding structures.**Electronic Effects:** Inductive, mesomeric, electromeric, resonance, and hyperconjugative effects. Steric effect. Effect on the properties and reactivities of organic compounds. **Reactive Intermediates:** Structure and Stability-Types of organic reactions - General concept of reactions. Substrate-Intermediate-TS energy profile diagram (Basic treatment) - Nomenclature of organic compounds.

Unit IV: Chemistry of Hydrocarbons

(15 hrs)

Petroleum source of alkanes - Methods of preparing alkanes and cycloalkanes - Mechanism of free radical substitution in alkanes by halogenation- chemical properties of cycloalkanes- Relative stability - Bayer's Strain theory and Sachtel's Theory. General methods of preparation of benzene - Chemical properties - Uses - Electrophilic substitution mechanism - Orientation and reactivity in substituted benzenes. Types of Polynuclear Aromatic compounds - Chemistry of Naphthalene- preparation and properties.

Unit V: Gaseous state

(15 hrs)

Maxwell's distribution of Molecular velocities (Derivation not required). Types of Molecular velocities - Mean, Most probable, and root mean square velocities. Graphical representation and its significance - Collision diameter, Mean free path, and collision number - Transport properties - Thermal conductivity, Viscosity, and Diffusion - Law of equipartition of energies - Degree of freedom. Molecular basis of Heat capacity - Real gases - van der Waal's equation of states - derivation - Significance of critical constants - Virial equations of state - Law of corresponding states - Compressibility factor.

Text Books:

1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997)

3. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)

Reference Books:

1. Lee J.D., Concise Inorganic Chemistry, UK, Black well science (2006)
2. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co. Ltd. (1976)
3. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976)
4. Frank J. Welcher and Richard B. Hahn, Semi micro Qualitative Analysis, New Delhi, Affiliated East-west Press pvt. Ltd.(1969)

CO- PSO Articulation Matrix:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	1	2	3	1	1	2	2	1	1	2
CO2	3	3	2	2	3	2	2	2	2	2	2	3
CO3	2	3	3	2	2	2	2	2	2	2	2	2
CO4	2	3	3	2	3	2	2	2	3	2	2	3
CO5	3	2	2	2	3	2	3	2	2	2	2	2

Possible Levels of Testing based on Bloom's Taxonomy:

Unit	Remember (K1)	Understand (K2)	Apply (K3)	Analyze (K4)	Evaluate (K5)	Create (K6)
Electron occupancy and periodic properties	✓	✓	✓	✓		
Chemical Bonding	✓	✓		✓		
Bonding in Organic Molecules	✓	✓	✓	✓		
Chemistry of Hydrocarbons	✓	✓	✓	✓		
Gaseous state	✓	✓	✓	✓	✓	

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	BCHF231T40	Applied Physics – I	3	0	1	4

Objective:

- Master the principles of material elasticity and beam bending, and rigorously derive Young's modulus.
- Critically analyze wave dynamics and oscillatory motion, focusing on ultrasonic generation methods.
- Comprehend laser principles, distinguishing between various types and their theoretical underpinnings.
- Explore the fundamental concepts and communication applications of optical fibers.
- Develop expertise in semiconductor devices and foundational digital electronics.

Course Outcome:

CO1: Analyze the properties and elastic behavior of materials, including the bending of beams, and accurately derive Young's modulus.

CO2: Apply the principles of acoustics to understand the diverse applications of sound waves, including the production of ultrasonics by different methods.

CO3: Demonstrate a comprehensive understanding of laser fundamentals, including the classification and application of different laser types.

CO4: Explain the foundational concepts of fiber optics, including the various types of fibers and the mechanisms of signal propagation through them.

CO5: Apply the principles and concepts of electronics to understand the functioning of electrical devices such as PN junction diodes, Zener diodes as peak clippers, and FETs.

Unit 1: Properties of matter

Elasticity - Stress – Strain – Hooke's law –Moduli of elasticity- Poisson's ratio- Elastic behaviour of Material – Factors affecting Elasticity – Young's modulus by cantilever-Non - uniform Bending

Unit 2: Technical acoustics

Reverberation time - Acoustics of buildings – Reverberation, echo, creep, focusing, standing wave, Principles to be observed in the Acoustical design of an Auditorium – Noise Pollution – Absorption coefficient - Ultrasonics -Generation – Piezoelectric method –Applications of Ultrasonics in industries.

Unit 3: Laser

Principles – Einstein theory of spontaneous and stimulated emission – Population inversion - Nd: YAG laser, CO₂ laser – Applications of Lasers in 3D profiling, computer peripherals such as CD-ROM.

Unit 4: Fibre optics

Types of Optical Fibers – step index – graded index single mode – multiple mode fiber – acceptance angle – Numerical aperture – applications in engineering and medicine.

Unit 5: Electronics

P-N Junction and P-N Junction Diode - Zener Diode – V-I Characteristics – Zener diode as Peak Clipper- Field Effect Transistors (FET) –Types – Junction Field Effect Transistor (JFET)– Static and Transfer Characteristics.

Text Books:

1. Venkatramanan, Raja, Sundarrajan. *Applied Physics for Engineers*. SCITECH Publishers, 2011.
2. R.K. Gaur & S.L. Gupta. *Modern Engineering Physics*. Dhanpat Rai Publications, 2011.
3. A.S. Vasudeva. *Modern Engineering Physics*. S. Chand & Company Ltd., 1999.
4. Bhattacharya, Bhaskaran. *Engineering Physics*. Oxford Publications, 2010.

References:

1. D.S. Mathur. *Properties of Matter*. S. Chand & Company Ltd., 2008.
2. Brijilal & Subramanian. *Sound*. S. Chand & Company Ltd., 1985.
3. Rubhan Kumar. *Engineering Physics*. McGraw Hill Education.
4. M.N. Avadhanulu. *Engineering Physics*. S. Chand & Company Ltd., 1992.
5. R. Agarwal. *Fiber Optics*. McGraw Hill Education, 2012.
6. B.L. Theraja. *Basic Electronics (Solid State)*. S. Chand & Company Ltd., 2007.

CO- PSO Articulation Matrix:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	2	3	2	1	2	1	2	2	1	2
CO2	2	3	2	3	3	2	2	2	2	2	2	3
CO3	2	2	3	2	3	3	2	2	1	2	2	2
CO4	2	2	2	3	3	3	3	3	2	3	2	3

CO5	2	2	2	2	3	2	2	2	2	3	2	2
-----	---	---	---	---	---	---	---	---	---	---	---	---

Possible Levels of Testing based on Bloom's Taxonomy:

Unit	Remember (K1)	Understand (K2)	Apply (K3)	Analyze (K4)	Evaluate (K5)	Create (K6)
Properties of Matter	✓	✓	✓	✓		
Technical Acoustics	✓	✓	✓	✓	✓	✓
Laser	✓	✓	✓	✓		
Fibre Optics	✓	✓	✓	✓		
Electronics	✓	✓	✓	✓	✓	

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	ICSF231T80	IndianCulture-I	1	-	-	1

Objectives:

- Foster understanding of the significance of ancient Indian systems and traditions.
- Highlight India's rich literary heritage and its reflection of early scientific advancements.
- Draw connections between contemporary science and Vedic scientific heritage.
- Identify ancient Indian contributions to various scientific fields and their impact on modern science.
- Enhance appreciation for the depth of ancient Indian knowledge systems.

Course Outcomes

CO1: Students will be able to explain the significance and historical context of ancient Indian systems and traditions.

CO2: Students will be able to analyze and interpret how India's literary heritage reflects early scientific and technological advancements.

CO3: Students will be able to draw connections between modern scientific concepts and ancient Vedic knowledge.

CO4: Students will be able to identify key contributions made by ancient Indians in various scientific fields and assess their relevance to contemporary science.

CO5: Students will be able to articulate the value and depth of ancient Indian knowledge systems in the context of modern scientific understanding.

Unit I

Introduction to Vedic Cultures; significance & how it is different from the other cultures. Why we have to follow? Important features.

Unit II

Literary Heritage of India – significance of Indian Literature; Chronology of Indian literature; Literature in Sanskrit and other Indian languages;

Unit III

Early Indian Education – significance & advantages. Gurukulas and Guru-shishya parampara. Learning methods. Evolution of script and languages; important early scripts and writing materials;

important early educational centers (ghattikas, universities) & their unique features. Important personalities and their Contribution – Devarishies, Maharishies, Rishies, Seers and contribution of their institutions to protect the cultural heritage.

Unit IV

Scientific thought of Early Indian Sages;

Unit V

Importance and significance of Upavedas – Ayurveda, Dhanurveda, Gandhravaveda, stapatya & Arthasastra.

Reference Books:

1. Joshi, K. (1992 [reprint]). *The Veda and Indian Culture*. Rastriya Veda Vidya Pratishthana, New Delhi.
2. Kangle, R.P. (1992 [reprint]). *The Kautilya Arthasastra*. Delhi.
3. Kulkarni, R.P. (1983). *Geometry according to Sulba Sutra*. Samsodhana Mandal, Pune.
4. Majumdar, R.C. (1994 [reprint]). *Ancient India*. Motilal Banarsidas Publishers, Delhi.
5. Patel, I.S. (Ed.). (1984). *Science and the Vedas*. Bombay.
6. Majumdar, R.C. (Ed.). (1996 [reprint]). *The History and Culture of the Indian People*, Vols. I-IV. Bharatiya Vidya Bhavan, Mumbai.
7. Radhakrishna, S. (1993 [reprint]). *Indian Philosophy*, Vols. I & II. Oxford University Press, Delhi.
8. Sri Chandrasekarendra Sarasvati Swamiji. (1991). *The Guru Tradition*. Bharatiya Vidya Bhavan, Bombay.
9. Sri Jayendra Saraswati ji Maharaj. (1951). *The Vedas and Vedangas*. Prakashan Kendra, Lucknow.
10. Winternize, M. (1996 [reprint]). *History of Indian Literature*. Delhi.

CO- PSO Articulation Matrix:

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	✓											
CO2	✓									✓		✓
CO3	✓				✓		✓		✓			✓
CO4	✓	✓		✓	✓	✓	✓	✓	✓	✓		
CO5	✓			✓	✓			✓	✓	✓	✓	

Semester	Sub.Code	Title of the Paper	L	P	T	Credits
I	BCHF231T50	Principles of Environmental Science	2	0	1	2

Course Objectives:

- ✓ **Foundational Understanding:** Introduce the fundamental components of the environment and its role in sustaining life, emphasizing the interconnections of natural systems.
- ✓ **Environmental Awareness:** Foster awareness of environmental issues, the reasons behind them, and different perspectives on the environment, including anthropocentric and ecocentric views.
- ✓ **Multidisciplinary Approach:** Highlight the multidisciplinary nature of environmental studies, emphasizing its scope and aims in addressing complex environmental challenges.
- ✓ **Sustainability Principles:** Introduce principles of sustainable development, focusing on the need to balance economic, social, and environmental factors for long-term well-being.
- ✓ **Resource Conservation and Pollution Control:** Define and classify natural resources and explore strategies for their conservation. Address various types of pollution, their causes, effects, and remedies to emphasize pollution control and mitigation.

Learning Outcomes:

Upon completing the Environmental Science course, students should be able to:

- ✓ **Demonstrate Comprehensive Environmental Knowledge:** Understand and explain the fundamental components of the environment, various types of natural resources, and the multidisciplinary nature of environmental studies.
- ✓ **Recognize Environmental Issues:** Identify and analyze the causes and consequences of environmental problems, demonstrating an awareness of the need for environmental conservation and sustainability.
- ✓ **Evaluate Perspectives:** Compare and contrast anthropocentric and ecocentric views on the environment, and understand how ethical considerations play a crucial role in environmental decision-making.
- ✓ **Apply Sustainable Principles:** Apply principles of sustainable development to evaluate and propose solutions for environmental issues, considering economic, social, and environmental factors.
- ✓ **Resource Conservation:** Distinguish between different types of natural resources, assess the consequences of their depletion, and propose strategies for resource conservation.
- ✓ **Pollution Management:** Recognize, evaluate, and propose solutions for various forms of pollution, including air, water, soil, noise, nuclear, and thermal pollution.
- ✓ **Engage with Global Agreements:** Understand the significance of international environmental agreements and their role in addressing global environmental challenges.
- ✓ **Environmental Ethics and Social Awareness:** Apply principles of environmental ethics to make ethically informed decisions related to environmental issues and understand the social and ethical dimensions of environmental challenges.

Unit - 1: Introduction to environmental studies & Natural resources

6hrs

Introduction to environment – components – nature of environment - need of awareness – reasons for environmental problems – anthropocentric and eco centric views. Environmental studies - multidisciplinary nature – scope and aim – sustainable development- principles – RRR concept-Indian environmental movements – environmental calendar.

Unit-2: Natural Resources

6 hrs

Natural resources – definition – types – forest resources – uses – deforestation- reasons – effects. Water resources – dams – effects of dams - food resources – modern agriculture– ill effects of agrochemical – integrated pest management- energy resources- types – hydel – nuclear – solar – wind and biomass energy.

Unit-3: Environmental Pollution

6 hrs

Pollution – definition – types – air pollution – causes and effects – effects of CO₂ – CO – NO_x – SO_x – particulates – control of air pollution – water pollution – causes – effects – remedies.

Unit-4 :Advanced PollutionSolution & Disaster Management

6 hrs

Soil pollution – solid waste management – Noise pollution – reasons – effects – control – nuclear pollution – cases – effects and control –thermal pollution causes – effects and remedies. e waste – ill effects of e-waste – proper recycling. Disaster management.

Unit – 5: Social issues and environmental ethics**6 hrs**

Present environmental scenario – greenhouse effect – climate change – The Kyoto Protocol- ozone layer depletion-The Montreal Protocol - acid rain – causes – effects - disparity among the nations – The Copenhagen UNFCCC summit – carbon currency- virtual water- genetically modified organisms,
Environmental ethics – introduction – people getting affected - resettlement and rehabilitation.

Text Book

- Anubha Kaushik and C.P. Kaushik,” Prospects of Environmental Science”, New Age International publishers, 2013.

Reference books

1. Environmental Studies, N. Nandini, N. Sunitha and Sucharita Tandon, Sapna Book House, 2007.
2. Text book of Environmental Science, Ragavan Nambiar, Scitech Publications, 2009.
3. Text book of Environmental Chemistry and Pollution Control, S.S.Dara, S.Chand and Co., 2002.
4. Environmental Chemistry, Colin Baird, W.H.Freeman and company, New York,1999.
5. Environmental Chemistry, Gary W. VanLoon and Stephen J.Duffy, Oxford University Press, 2000.
6. New Trends in Green Chemistry, V.K. Ahluwalia and M. Kidwai, Anamaya Publishers, 2006.

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	BCHF231P60	Major Practical- I	-	3	-	2

MAJOR PRACTICAL – I- VOLUMETRIC ANALYSIS

I Titrimetric Quantitative Analysis

1. Estimation of HCl by NaOH using a standard oxalic acid solution
2. Estimation of Na₂CO₃ by HCl using a standard Na₂CO₃ solution
3. Estimation of oxalic acid by KMnO₄ using a standard oxalic acid solution
4. Estimation of Iron (II) sulphate by KMnO₄ using a standard Mohr's salt solution.
5. Estimation of Ca (II) by KMnO₄ using a standard oxalic acid solution.
6. Estimation of KMnO₄ by thio using a standard K₂Cr₂O₇ solution.
7. Estimation of Fe (III) by using K₂Cr₂O₇ using a standard Mohr's salt solution using internal and external indicators.
8. Estimation of copper (II) sulphate by K₂Cr₂O₇ solution
9. Estimation of Mg (II) by EDTA solution
10. Estimation of Total Hardness of water
11. Estimation of chlorine in Bleaching Powder

Reference:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of ractical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)

<u>Scheme of Valuation</u>	
Record	10 marks
Procedure Writing	20 marks
Experiment	30 marks
Calculation	20 marks
Results	10 marks

< 2 % - 10 marks 3 % - 8 marks 4 % - 6 marks 5 % - 4 marks >5 % - 2 marks	
Viva	10 marks
Total	100 MARKS

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	BCHF231P70	Applied Physics Lab - I	-	3	-	2

List of Experiments:

1. Torsional pendulum
2. Young's modulus – non uniform bending
3. Ultrasonic Interferometer
4. Determine wavelength of LASER source
5. Determine particle size - LASER
6. Optical Fibre – Numerical aperture & acceptance angle
7. p-n junction diode – V-I Characteristics
8. Zener diode - V-I Characteristics
9. Zener diode as peak clipper
10. Field Effect Transistors
11. Study of CRO

Text Books:

- [1]. M.N. Srinivasan, S. Balasubramanian, R. Ranganathan, "A Textbook of Practical Physics", Sultan Chand & Sons, 2015

References:

- [1]. C.C. Ouseph, U.J. Rao and V. Vijayendran, "Practical Physics and Electronics", S. Viswanathan Publishers, Pvt.Lt.d, 2011
- [2]. K. Venkatramanan, M. Sundarajan, R. Raja, "Experimental Physics for Engineers", SciTech Publications, Chennai, 2011
- [3]. Harnam Singh, "B.Sc. Practical Physics", S. Chand Publishing, 2000

Semester-II

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	CLTS232T10	Tamil -II	3	-	1	3

Objective:

Objective-1	பக்தி இலக்கியம் பக்தி இலக்கியங்கள் வழி சமயச் சான்றோர்களின் கருத்துக்களை உணர்த்துதல்
Objective-2	அறஇலக்கியம் வாழ்வை மேம்படுத்தும் அற சிந்தனைகளை நீதி இலக்கியம் வழி உணர்த்துதல்
Objective-3	இலக்கணம் இலக்கணமும் மொழித் திறனும் மொழியை பிழையின்றி பேச எழுத கற்க தேவையான தமிழ் இலக்கணத்தின் இன்றியமையாமையை உணர்த்துதல்
Objective-4	அறிவியல் தமிழ் மற்றும் கனித்தமிழ் மாணவர்களின் வாசிப்பு திறனையும் படைப்புத் திறனையும் மேம்படுத்த சமூகப் பிரச்சனைகளை அறிய வைத்தல்
Objective-5	மொழிப் பயிற்சி மொழியினைப் பிழையின்றி கற்பதற்கும் ஒரு பொருள் குறித்த பல சொற்கள் பல பொருள் குறித்த ஒரு சொல் குறித்து அறிய செய்தல்

Outcome:

On the successful completion of the course, students will be able to

CO Number	CO Statement
CO -1	பக்தி இலக்கியம் பக்தி இலக்கியங்கள் வழி பக்தி நெறிகளை உணர்ந்து கொள்ளுதல்
CO -2	அற இலக்கியம் அற இலக்கியங்கள் வழி ஒழுக்கங்களை கற்றுக் கொள்ளுதல்
CO -3	இலக்கணம் இலக்கணமும் மொழித்திறனும் மொழியை பிழையின்றிப் பேச எழுத கற்கத் தேவையான தமிழ் இலக்கணத்தின் இன்றியமையாமையை உணர்ந்து கொள்ளுதல்
CO -4	அறிவியல் தமிழ் மற்றும் கனித்தமிழ்

	அறிவியல் தமிழ் மற்றும் தனித்தமிழ் குறித்த அறிவையும் இணைய கல்வி குறித்து அறிவினையும் பெறுதல்
CO-5	மொழிப் பயிற்சி மொழினை பிழையின்றி கற்பதற்கும் பிற துறைச் சார்ந்த கலைச் சொற்களையும் அறிந்து கொள்ளுதல்

அலகு-1பக்திஇலக்கியம்

தெய்வத்தின்குரல்-குருபக்தி-குருகுலவாசம்-உலகபடைப்பின்காரணம்-ஆச்சாரியாஇலக்கணம்-குருஇலக்கணம்-சுவாமிநாதன்ஜனனம்-குருவிடம்சரணம்-13 வயதில்பீடாதிபதி-பட்டாபிஷேகம்-வித்வான்கள்மத்தியில்-எளியவரிடம்இரக்கம்-பைரவனின்பக்தி-யானையிடம்பரிவு-பெருமாளேசாட்சி-அமுதமாகும்மோர்-அன்னதானசிவன்-அகிம்சைமுறையில்தயாரித்தபட்டு--அம்பாளின்வஸ்திரம்-கனகாபிஷேகம்-கௌமாரம்சமயம்-திருப்புகழ்அருணகிரிநாதர்- கணபத்தியம்-விநாயகர்அகவல்கள்-சரஸ்வதிஅந்தாதிகம்பர்

அலகு2 அறஇலக்கியம்

திருக்குறள்- நட்பு,கூடாநட்பு,உழவு,மருந்து,
நாலடியார்- 1 ,29, 100, 125, 139
கொன்றைவேந்தன் - முதல்20பாடல்களுக்குகதைஎழுதுதல்
ஆசாரக்கோவை-10, 25

அலகு -3இலக்கணம்

சொல்- இலக்கணம்வகைகள்- பெயர்ச்சொல் - வினைச்சொல் -இடைச்சொல் - உரிச்சொல்

அலகு-4 அறிவியல்தமிழ்மற்றும்கனித்தமிழ்

அறிவியல்தமிழின்வளர்ச்சி- தனித்தமிழ்வளர்ச்சி-தமிழ்நூல்களையின்பதிப்புசெய்தல்-
தமிழ்மென்பொருட்களைஉருவாக்கும்- தமிழ்இணையகல்விக்கழகம்- தமிழ்மின்நூலகம்-
இணையத்தில்தமிழ்அகராதிகள்-சொற்குவைத்திட்டம்

அலகு-5மொழிப்பயிற்சி

இலக்கணகுறிப்புகள்ஒருபொருள்குறித்தபலசொற்கள்பலபொருள்குறித்தஒருசொல்அகரவரிசைப்படுத்துதல்ஒருமைபன்மைமயக்கம்

பாடநூல் :-

1. தெய்வத்தின்குரல்தொகுப்பாசிரியர்ராகணபதிவானதிபதிப்பகம்சென்னை -17
2. பதினெண்கீழ்க்கணக்குமுல்லைநிலையம்2009பதிப்புசென்னை
3. ஸ்ரீபெரியவாளின்ஆன்மீகஅனுபவங்கள்கங்காராமமூர்த்திஅல்லயன்ஸ்கம்பெனிமைலாப்பூர்சென்னை -4
4. கணினிதமிழ்முனைவர்இலசுந்தரம்விகடன்பிரசுரம்
5. வகைமைநோக்கிஇலக்கியவரலாறுநியூசெஞ்சரிபுக்ஹவுஸ்சென்னை

பார்வைநூல் :-

1. க. த. திருநாவுக்கரசுதிருக்குறள்நீதிஇலக்கியம்சென்னைபல்கலைக்கழகம்வெளியீடு

2. தமிழ்இலக்கியவரலாறுஜெயம்ஜனகாபதிப்பகம்
3. அறஇலக்கியத்தில்வாழ்வியல்விழுமியங்கள்செம்முதாய்பதிப்பகம்சென்னை

Course Outcome (CO)	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO-1 (பக்திஇலக்கியம்)	3	2	2	1	1	1	2	1	1	1	1	1
CO-2 (அறஇலக்கியம்)	3	3	2	1	1	1	2	1	1	1	1	1
CO-3 (இலக்கணம்)	3	2	3	1	1	1	2	1	1	1	1	1
CO-4 (அறிவியல்தமிழ்&கனித்தமிழ்)	2	2	2	1	1	1	2	1	1	1	1	1
CO-5 (மொழிப்பயிற்சி)	3	2	2	2	1	1	2	1	1	1	1	1

Possible Levels of Testing Based on Bloom's Taxonomy:

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
பக்திஇலக்கியம்	✓	✓	✓			
அறஇலக்கியம்	✓	✓	✓	✓		
இலக்கணம்	✓	✓	✓	✓		
அறிவியல்தமிழ்மற்றும்கனித்தமிழ்	✓	✓	✓	✓		
மொழிப்பயிற்சி	✓	✓	✓	✓		

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	CLES232T20	English -II	3	-	1	3

Objectives:

1. To encourage the students to read English essays and appreciate it
2. To get inspiration from the great speeches by elite personalities
3. To enhance the language skills through literature
4. To be familiar with English grammar and its usage
5. To get the ability to construct grammatically correct and meaningful sentences

Course Outcomes:

Students will be able to:

CO1: Read and appreciate the text in English language

CO2: Present the ideas in their own words

CO3: Comprehend the significance of literature in learning language

CO4: Understand that grammar and vocabulary can create different meanings.

CO5: Write and speak with proper usage of grammar.

UnitI: Prose

1. Stephen Leacock : My Lost Dollar
2. O.Henry : The Last Leaf
3. G.K.Chesterton : On Running after One's Hat

UnitII: Great Speeches

1. Steve Jobs : Stanford Commencement Address
2. Albert Einstein : The Common language of science
3. Bill Gates : The Future of Innovation

UnitIII:One Act Play

Rabindranath Tagore : Chitra (A Play in One Act)

UnitIV:GrammarI

1. Relativepronouns
2. Adverbs
3. Prepositions
4. Phrasalverbs
5. Idioms

UnitV:GrammarII

6. ActiveVoice&PassiveVoice
7. Infinitives&Gerunds
8. Conditionals
9. Collocations
10. AmericanandBritishwords

Bookprescribed:

1. Aggarwala,N.K.AseniorEnglishGrammar&Composition.NewDelhi:GoyalBrothers.1995.
2. <http://www.theatrehistory.com/plays/chitra001.html>

CO- PSO Articulation Matrix

Course Outcome (CO)	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	1	1	1	1	1	2	2	3	2	2
CO2	2	1	1	1	2	2	1	1	2	3	3	3
CO3	2	2	2	1	1	1	1	2	3	2	2	2
CO4	3	2	2	2	3	2	2	2	3	3	3	2
CO5	3	2	2	2	3	2	2	2	3	3	3	2

Possible Levels of Testing based on Bloom's Taxonomy:

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Prose	✓	✓				
Great Speeches	✓	✓		✓		
One Act Play	✓	✓				
Basic Grammar - II	✓	✓	✓	✓		
Grammar -II	✓	✓	✓	✓		

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	BCHF232T30	Principles of Chemistry – II	4	0	1	5

Objectives

- To understand stoichiometry, redox reactions, and their calculation methods, including redox equation balancing techniques.
- To explore the nomenclature, preparation, properties, and reaction mechanisms of haloalkanes, including stereochemistry and elimination reactions.
- To study the preparation, properties, and uses of phenols and ethers, including their important derivatives and laboratory preparation methods.
- To learn the classification of solids, crystallography, X-ray diffraction, and the properties and applications of colloids.
- To gain insights into reaction rates, rate laws, methods of determining reaction order, and catalysis theories and examples.

Outcome

After the course, the students are expected to gain knowledge about

CO1: The students will gain knowledge about Qualitative analysis, including stoichiometry, redox reactions, and their balancing methods.

CO2: The students will understand the chemistry, nomenclature, and reactions of organohalogen compounds.

CO3: The students will understand the chemistry of phenols and ethers, including their preparation, properties, and uses.

CO4: The students will comprehend the principles of solid state chemistry and colloidal systems, including their classification, properties, and methods of preparation.

CO5: The students will gain insight into chemical kinetics and catalysis, including rate laws, reaction rates, and the theories explaining reaction mechanisms.

Unit I: Stoichiometry and Redox reactions

(15 hrs)

Covalency: Oxidation number, Oxidation state, stoichiometry, and its calculations, Limiting Reagents, Equivalent mass concept (Acid and Bases only) -Redox Reactions and their types- Half Reactions-oxidizing and reducing agents-Equivalent weight of oxidizing and reducing agents- Balancing Redox equations by oxidation number method-Ion electron method.

Unit II: Organohalogen Compounds

(15 hrs)

Nomenclature – general methods of preparation of haloalkanes – physical and chemical properties – nucleophilic substitution mechanisms (S_N1 , S_N2 and S_Ni) – evidences – stereochemical aspects of nucleophilic substitution mechanisms – Elimination reactions (E_1 and E_2) – Hoffmann Saytzeff rule-general methods of preparation of benzyl chloride – physical and chemical properties.

Unit III: Chemistry of Phenols and Ethers

(15 hrs)

Preparation of phenols including di and tri hydric phenols – physical and chemical properties – uses – derivatives of phenol (aspirin, methyl salicylate, salol) - laboratory preparation of ethers, epoxides – 1,4 dioxane - physical and chemical properties – uses.

Unit IV: Solid state and Colloids

(15 hrs)

Classification of solids – Laws of crystallography – representation of planes – Miller indices, space lattice, crystal systems – seven primitive, unit cells – X -ray diffraction – derivation of Bragg's equation – determination of structure of NaCl by Debye Scherrer (powder method) and rotating crystal method-Colloids-definition-classification – general methods of preparation (double decomposition, Mechanical dispersion methods only)–Purification-Mechanical, optical and electrical Properties of colloids –coagulation-peptization - gold number – applications of colloids.

Unit V: Chemical Kinetics and Catalysis

(15 hrs)

Rate of reaction, average and instantaneous rates, rate equation, order of reaction. Rate laws: rate constants – derivation of rate constants and characteristics for zero, first and second order (equal initial concentration) – derivation of half life period. Methods of determination of order of reactions – half life period and graphical method – experimental methods of determination of rate constant of a reaction – volumetry, manometry, polarimetry.

Effect of temperature on reaction rate - concept of activation energy, energy barrier, Arrhenius equation. Theories of reaction rates - collision theory - derivation of rate constant of bimolecular gases reaction - failure of collision theory – Lindemann's treatment- Theory of absolute reaction rates.Catalysis –Introduction, types and Examples.

Text Books:

1. Puri B.R.,Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997)
3. Puri B.R.,Sharma L.R., PathaniaM.S.,Principles of Physical Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)

Reference Books:

1. Lee J.D.,Concise Inorganic Chemistry, UK, Black well science (2006)
2. Glasstone S., Lewis D.,Elements of Physical Chemistry, London, Mac Millan & Co. Ltd. (1976)
3. Morrison R.T. and Boyd R.N.,Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976)
4. Frank J. Welcher and Richard B. Hahn, Semi micro Qualitative Analysis, New Delhi, Affiliated East-west Press pvt.Ltd.(1969)
5. R.D.Madan, Modern Inorganic Chemistry, S.Chand and Company Ltd., New Delhi.(2002)

CO-PSO Articulation Matrix:

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	3	3	0	2	0	0	0	0	0	0	0
CO2	3	3	3	0	0	0	0	0	0	0	0	0
CO3	3	3	3	0	0	0	0	0	0	0	0	0
CO4	3	0	0	0	0	0	0	0	1	0	0	0
CO5	3	0	2	3	3	3	3	0	0	0	0	0

Possible Levels of Testing based on Bloom's Taxonomy:

Unit	Remember (K1)	Understand (K2)	Apply (K3)	Analyze (K4)	Evaluate (K5)	Create (K6)
Stoichiometry and Redox Reactions	✓	✓	✓	✓		
Organohalogen Compounds	✓	✓	✓	✓		
Chemistry of Phenols and Ethers	✓	✓	✓	✓		
Solid State and Colloids	✓	✓	✓	✓		
Chemical Kinetics and Catalysis	✓	✓	✓	✓	✓	✓

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	BCHF232T40	Applied Physics – II	3	0	1	4

Objective:

- To study the properties and synthesis of Nanomaterials
- To familiarize the properties of para, dia, Ferro, Ferri and antiferromagnetism
- To explore the preparation, properties and applications of SMA, Metallic glasses and Biomaterials.
- To study the characteristics of special purpose diodes [PIN diode, Photodiode, LCD and LCD]
- To familiarize the IC Fabrication and Logic gates

Outcome:

CO1: Understand the properties, Synthesis of nanomaterials and bending of beams, analyse Physical vapour deposition method and applications of nanomaterials

CO2: Experience the diverse applications of Magnetic materials and properties. Learn the basic properties of dielectric materials

CO3: Adequate knowledge of engineering materials, metallic glasses & superconductors

CO4: Basic knowledge on various types of optoelectronic devices and applications

CO5: Knowledge on the principles and concepts of Integrated circuits, Classification of ICs by Structure and function, linear and digital integrated circuits, fabrication of IC components

Unit 1:Nano Physics

Introduction to Nano materials - Quantum confinement – Properties of nano materials – Synthesis of nano materials – Top down and bottom up approach – Ball milling and Physical vapour deposition method – applications of nano materials – CNTs

Unit 2:Magnetism & Dielectrics

Types of Magnetic materials (Dia, Para and Ferro)– properties – Application- Floppy Disc - Dielectrics- Basic Definitions –Dielectric Breakdown – Dielectric loss– Internal field – Classius- Mossotti relation. Application of Dielectric materials

Unit 3:Engineering Materials

Introduction and Properties of Metallic glasses – Shape memory alloys – Bio materials - Superconductors- Introduction – Meissner effect – Type I & Type II superconductors – High Tc Superconductors

Unit 4: Optoelectronic Devices

Photomultiplier Tube – Photo Conductive cells – P-N junction Photodiode – PIN Photodiode- Avalanche Photodiodes - Light Emitting Diode (LED) – Liquid Crystal Display (LCD)

Unit 5: Integrated Circuits & Logic Gates

Introduction – Scale of Integration - Classification of IC's by Structure and function – Linear and Digital Integrated Circuits- Fabrication of IC Components – Logic Gates- Positive and Negative Logic- The OR, AND, NOT Gates – Symbols and Truth table for Logic Operations – Universal Gates – The NAND & NOR gates – Symbols and Truth Table for Logic operations.

Textbooks

1. Gaur, R.K., and S.L. Gupta. *Modern Engineering Physics*. Dhanpat Rai Publications, 2011.
2. Vasudeva, A.S. *Modern Engineering Physics*. S. Chand & Company Ltd., 1999.
3. Bhattacharya, Bhaskaran. *Engineering Physics*. Oxford Publications, 2010.
4. Venkatramanan, Raja, and Sundarrajan. *Applied Physics for Engineers*. SCITECH, 2011.

References

1. Murugesan, R. *Modern Physics*. S. Chand, 2011. (Unit I)
2. Avadhanulu, M.N. *Engineering Physics*. S. Chand, 1992. (Units II & III)
3. Palanisamy, P.K. *Engineering Physics*. Scitech Publications, 2009. (Units II & III)
4. Thereja, B.L. *Basic Electronics (Solid State)*. S. Chand, 2007. (Units IV & V)

CO-PSO Articulation Matrix

Course Outcomes (COs)	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1:	0	2	2	0	0	0	3	0	0	0	0	0
CO2	0	0	0	0	0	0	0	0	3	0	0	0
CO3	3	0	0	0	0	2	0	0	0	0	0	0
CO4	0	0	0	3	0	0	0	0	0	0	0	0
CO5	0	0	0	3	3	2	2	0	0	0	3	2

Possible Levels of Testing Based on Bloom's Taxonomy

Unit	Remember (K1)	Understand (K2)	Apply (K3)	Analyze (K4)	Evaluate (K5)	Create (K6)
Nano Physics	✓	✓	✓	✓	✓	✓
Magnetism & Dielectrics	✓	✓	✓	✓	✓	✓
Engineering Materials	✓	✓	✓	✓	✓	✓
Optoelectronic Devices	✓	✓	✓	✓	✓	✓
Integrated Circuits & Logic Gates	✓	✓	✓	✓	✓	✓

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	BCHF232T60	Cyber security	1	-	-	1

COURSE OBJECTIVES

- To introduce the basic concepts of cyber security
- To acquire knowledge on cyber threats and attacks
- To become aware of significant security technologies and tools
- To impart knowledge on cipher methods and cryptographic algorithms
- To gain knowledge about physical security and digital forensics

COURSE OUTCOMES

- Understand the basic concepts, need, approaches, principles and components of security.
- Explain the various cyber threats and attacks.
- Describe the various Security Technologies and Tools.
- Explain the basic principles of cryptography and algorithms.
- Able to explain importance of digital forensics

UNIT – I INTRODUCTION TO CYBER SECURITY

Introduction – Need for Security – Security Approaches – Principles of Security - Components – Balancing Security & Access – Software Development Life Cycle .

6

UNIT – II CYBER SECURITY – THREATS & ATTACKS

Threats: Intellectual Property - Software Attacks – Deviations in QoS – Theft – Hardware Failures – Software Failures Attacks: Malicious Code – Hoaxes – Back Doors – Password Crack – Brute Force – Dictionary – DoS and DDoS – Spoofing.

6

UNIT – III SECURITY TOOLS & TECHNOLOGIES

Firewall and VPNs – Intrusion, Detection and Prevention Systems –Access Control – Firewalls – Protecting Remote Connections.

6

UNIT – IV CYRPTOGRAPHY

Cryptology Terminology - Cipher methods – Cryptographic Algorithms – Cryptographic tools – Attacks on cryptosystems

6

UNIT – V PHYSICAL SECURITY AND DIGITAL FORENSICS

Physical Access Controls – Fire Security and Safety – Failures of Supporting Utilities and Structural Collapse – Digital Forensics.

6

TOTAL: 30

TEXT BOOKS:

1. Michael E. Whitman, Herbert J. Mattord,” Principles of Information Security”, CENGAGE Learning, 4th Edition, 2012.

REFERENCE BOOKS:

1. William Stallings,” Cryptography and Network Security – Principles and Practice”, Pearson Education, 7th Edition.2017.
2. Atul Kahate,” Cryptography and Network Security”, Mc Graw Hill, 4th Edition, 2019.

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	1	0	0	1	0	0	0	0	0	0
CO2	3	3	2	1	0	1	0	0	0	1	0	0
CO3	3	2	3	1	0	2	0	0	1	0	0	0

Semester	Sub.Code	Title of the Paper	L	P	T	Credits
II	BCHF232T50	Computer for chemist	2	0	1	2

Objectives:

1. To gain foundational knowledge in using computers, including file management, input and output units, and understanding hardware and software components.
2. To develop skills in Microsoft Office applications, including Word, Excel, and PowerPoint, focusing on text formatting, data management, and presentation creation.
3. To understand the types of chemical file formats creating them for scientific data representation.

Course Outcomes (COs):

CO1: Demonstrate proficiency in basic computer operations, file management, and understanding of hardware and software components.

CO2: Effectively use Microsoft Word for document creation, formatting, and management, Excel for data analysis and visualization, and PowerPoint for creating and presenting slides.

CO3: Apply ChemDraw software to create and manipulate chemical structures and interpret various chemical file formats for scientific research and communication.

Unit-1 – Introduction to computers: Computer Basic, Creating Folder, Paint - Directories, input units, Output unit - Central Processing Units, -hardware, Software - Windows shortcut keys hardware

Unit-2 – MSOffice: MS WORD- Text Basics, Text Formatting, and saving files, Working with Objects, Header and footers, working with bullets and numbered lists, Tables, Styles and Content, Merging Documents, Sharing and Maintaining Documents, Proofing the document, Printing. MS EXCEL Introduction to Excel, Formatting Excel workbook, performing calculations with Functions, Sort and Filter Data with Excel, Create Effective Charts to Present Data Visually. MS POWERPOINT- Setting Up PowerPoint Environment, creating slides and applying themes, Working with bullets and numbering, Working with Objects, Hyperlinks, and Action Buttons.

Unit-3 -Introduction of chemistry software: Chemical file format- Distinguishing formats- Chemical Markup Language- Protein Data Bank Format, GROMACS format, CHARMM format, SMILES, MDL number.

CO-PSO Articulation Matrix

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	1	0	0	1	0	0	0	0	0	0
CO2	3	3	2	1	0	1	0	0	0	1	0	0
CO3	3	2	3	1	0	2	0	0	1	0	0	0

Possible Levels of Testing Based on Bloom's Taxonomy

Unit	Remember (K1)	Understand (K2)	Apply (K3)	Analyze (K4)	Evaluate (K5)	Create (K6)
Introduction to Computer	✓	✓	✓			
MS-Office	✓	✓	✓	✓		
ChemDraw and Chemical File Formats	✓	✓	✓	✓		✓

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	BCHF232P70	Major Practical- II	-	3	-	2

MAJOR PRACTICAL – II

1. Chemical kinetics – Clock reaction rate calculation.
2. Chemical kinetics – clock reaction effect of temperature and E_a calculation.
3. Determination of solubility of oxalic acid – Titrimetric method.
4. Determination of equivalent weight of $KMnO_4$ – Titrimetric method
5. Colorimetry - Verification of Beer- Lambert's law.
6. Colorimetry – Determination of unknown concentration
7. Colorimetry - Determination of glucose (o-toluidine method)
8. Determination of saponification value of an oil.
9. Systematic analysis of a simple salt.

<u>Scheme of Valuation</u>	
Record	10 marks
Procedure Writing	20 marks
Experiment	30 marks
Calculation	20 marks
Results < 2 % - 10 marks 3 % - 8 marks 4 % - 6 marks 5 % - 4 marks >5 % - 2 marks	10 marks
Viva	10 marks

Total	100 MARKS
--------------	------------------

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	BCHF232P80	Applied Physics Lab - II	-	3	-	2

List of Experiments:

1. Comparison of magnetic moments – Tan A & Tan B – Equidistance method
2. Comparison of magnetic moments – Tan A & Tan B – Null deflection method
3. Dielectric constant
4. Basic Logic gates
5. NAND – Universal building block
6. NOR – Universal building block
7. Determination of Particle size – LASER
8. Determination of wavelength of LASER
9. De-Morgan's theorem
10. Study of CRO

Text Books:

- [1]. M.N. Srinivasan, S. Balasubramanian, R. Ranganathan, "A Textbook of Practical Physics", Sultan Chand & Sons, 2015

References:

- [1]. C.C. Ouseph, U.J. Rao and V. Vijayendran, "Practical Physics and Electronics", S. Viswanathan Publishers, Pvt.Lt.d, 2011
- [2]. K. Venkatramanan, M. Sundarajan, R. Raja, "Experimental Physics for Engineers", SciTech Publications, Chennai, 2011
- [3]. Harnam Singh, "B.Sc. Practical Physics", S. Chand Publishing, 2000

Semester-III

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	CLTS233T10	Tamil -III	3	-	1	3

Objective:

Objective-1	பக்தி இலக்கியம் பக்தி இலக்கியங்கள் வழி சமயச் சான்றோர்களின் கருத்துக்களை உணர்த்துதல்
Objective-2	காப்பியம் காப்பிய இலக்கியங்களை அறிவியல் தொழில்நுட்பத்தின் வழி கற்றுக் கொடுத்தல்
Objective-3	கலைகள்மற்றும் விளையாட்டுகள் கைவினைப் பொருட்கள் குறித்த தொழில்நுட்பத்தைக் கற்றுக்கொடுத்தல்மாணவர்களுக்கு மன அழுத்தம் நீங்கவும் உற்சாகத்தை பெரும் நோக்குடன் கலைகள் மற்றும் விளையாட்டுகள் கற்றுத் தரப்படுகிறது
Objective-4	இலக்கியமும் கணித அறிவியலும் தமிழ் புலவர்கள் இயற்றிய இலக்கியங்களின் வழி கணித அறிவியல் சார்ந்த செய்திகளைக் கற்றுக் கொடுத்தல்
Objective-5	படைப்பிலக்கியப் பயிற்சி மாணவர்கள் தங்களுக்குள் இருக்கும் திறமையை வெளிப்படுத்தும் விதமாக அவர்களின் தனித்திறன் ஊக்கப்படுத்த பயிற்சி அளிக்கப்படுதல்

Outcome:

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO Number	CO Statement
CO -1	பக்தி இலக்கியம் பக்தி இலக்கியங்கள் வழி பக்தி நெறிகளை உணர்ந்து கொள்ளுதல்
CO -2	காப்பியம் காப்பிய இலக்கியங்களில் அறிவியல் தொழில்நுட்பத்தை அறிந்து கொள்ளுதல்
CO -3	கலைகள்மற்றும் விளையாட்டுகள் மாணவர்கள் கைவினைப் பொருட்கள் உருவாக்கும் திறன் குறித்து அறிந்து கொள்ளுதலும் பயிற்சிப் பட்டறையின் வாயிலாக கைவினைப் பொருட்களை உருவாக்குதல். விளையாட்டு,கலைகள் மூலம் மாணவர்கள் உற்சாகம் பெறுகின்றனர். நமது பழமையை பாரம்பரியத்தை அறிய உறுதுணை புரிகின்றது விளையாட்டுக்களினால் வெற்றி தோல்வியை ஏற்றுக்கொள்ளும் மனப்பக்குவமும் உடல் ஆரோக்கியத்தையும் பெறுகின்றனர்.
CO -4	இலக்கியமும் கணித அறிவியலும் தமிழ் இலக்கியங்களின் ஊடாக கணித அறிஞர்களின்

	தூத்திரங்களையும் பயன்பாட்டையும் தமிழ் புலவர்களின் பாடல்கள் வழி கற்றுக் கொள்ளுதல்
CO-5	படைப்பிலக்கிய பயிற்சி மாணவர்கள் தங்கள் தனி திறமை அறிந்து தங்களின் திறமைகளை படைப்புகளை படைத்துக் காட்டுதல்

அலகு 1பக்தி இலக்கியம்

காஞ்சி மகா பெரியவர்-தர்மங்களில் தலையானது தானம்-திருமாலும் அம்பிகையும்- முருகனும் மூத்தோனும்-குருகுலம் -கடிகா ஸ்தானம்-குரு ஆச்சாரியார் வாத்தியார்- உபாத்தியாயர் பெற்ற உயர்வு-வித்யா தனத்தின் உயர்வு-மாணவன் லட்சணம்-காரிய நிறைவு நிறைவு கரிமுகணாலேயே- ஆனைக்கா ஆனைமுகன்-குரு பக்தியின் அனுகூலங்கள்-வாழ்க்கையில் வழியும் திசையும்-ஆத்மா உயிர்மயமானது தத்துவ பொருள் மட்டுமன்று-"குரு"இலக்கணச் செய்யுள்

அலகு 2 காப்பியம்

சிலப்பதிகாரம்- வஞ்சி காண்டம், சீவக சிந்தாமணி- நாமகள் இலம்பகம், கம்ப ராமாயணம்- யுத்த காண்டம்- மீட்சி படலம், சீராபுராணம்- திருநின்ற சருக்கம்' தேம்பாவணி- பாயிரம், இருண்ட வீடு, குடும்ப விளக்கு- பாரதிதாசன்

அலகு -3 கலைகள்மற்றும் விளையாட்டுகள்

மண்பாண்டங்கள் -மூங்கில் குடைகள் வனைதல் - பாய் முடைதல் - பட்டு நெசவு செய்தல் - மண் பொம்மைகள் செய்தல் - கூடை பின்னுதல் - கலைஞர்கள் அணியும் அணிகலன் செய்தல் திட்டம்- தெருக்கூத்து- கரகாட்டம் - வில்லுப்பாட்டு -கணியான் கூத்து - ஓயிலாட்டம் - தோல்பாவை கூத்து- சிலம்பாட்டம் -வளரி -புலியாட்டம் - தமிழர்களின் விளையாட்டு (PROJECT)

அலகு-4 இலக்கியமும் கணித அறிவியலும்

போதையனார் கர்ணம் கண்டறிதல் - குறுக்கையூர் காரி நாயனார் கணக்கதிகாரம் - என் அறிதல் - நில வளம்அறிதல் - நுட்ப அறிதல் - களஞ்சியறிதல் - எடை அறிதல்- நாழிகை அறிதல்- அகவை அறிதல் -தேவகாலம் அறிதல்- வெற்றிலை கணக்கு- நெல் விற்பனை கணக்கு- பால் கணக்கு- முத்து கணக்கு -ரத்தின வாணிபக் கணக்கு - வெள்ளரிக்காய் கணக்கு- கற்பூர கணக்கு

அலகு-5 படைப்பிலக்கிய பயிற்சி

கவிதை,சிறுகதை, நூல் மதிப்பீட்டு பயிற்சி ஏதேனும் ஒரு கருவை கொடுத்து கதை கவிதை எழுதச் செய்தல்

பாடநூல் :-

1. தெய்வத்தின் குரல் தொகுப்பாசிரியர் ரா கணபதி வானதி பதிப்பகம் சென்னை -17
2. சிலப்பதிகாரம் புலியூர் தேசிகன் பாரிநிலையம் சென்னை-108

3. மணிமேகலைபுலியூர் தேசிகன் பாரிநிலையம் சென்னை-108
4. சீவக சிந்தாமணிபுலியூர் தேசிகன் பாரிநிலையம் சென்னை-108
5. சீறாப்புராணம்புலியூர் தேசிகன் பாரிநிலையம் சென்னை-108
6. கவினமிகு கைவினைப் பொருட்கள் செய்முறையும் விளக்கமும் நர்மதா பதிப்பகம்
7. கணக்கு அதிகாரம் கொறுக்கையூர் காரி நாயனார் திருநெல்வேலி தென்னிந்திய சைவ சித்தாந்த நூல் பதிப்பு கழகம் திருநெல்வேலி
8. பெரிய புராணம்புலியூர் தேசிகன் பாரிநிலையம் சென்னை-108

பார்வை நூல் :-

1. தமிழ் இலக்கியங்களில் வாழ்வியல் சிந்தனைகள் பல்லவி பதிப்பகம் ஈரோடு-11
2. வகைமை நோக்கி தமிழ் இலக்கிய வரலாறு, பாக்கிய மேரி,நியூ செஞ்சரி புக்

ஹ
வு
ஸ்
செ
ன்

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	CLES233T20	English –III	3	-	1	3

னை

Objectives:

1. To use listening strategies to identify the main ideas from different sources.
2. To identify the characteristics of effective speaking and to express the ideas with proper vocabulary and sentence formation.
3. To activate and reinforce the basic skills – grammar, vocabulary, pronunciation and writing.
4. To use the required writing conventions when creating a paragraph or any type of writing.
5. To apply LSRW skills in regular practice.

Course Outcomes:

Students will be able to:

1. Use cohesion mechanism to distinguish different ideas
2. Speak with a reasonable degree of fluency and accuracy.
3. Understand and use proper vocabulary, grammar and make use of language resources (e.g dictionary and thesaurus)
4. Describe, analyze and present the information clearly, concisely and logically.
5. Comprehend and use the strategies of LSRW in real time.

UNIT I: LISTENING

- Introduction to listening,
- Listen for gist and respond
- Listen for details and key words to understand specific meaning
- Listen and respond to questions and requests for personal information
- Listen to simple conversations in everyday contexts and respond
- Listen to lectures, presentations and other suitable listening materials from electronic media, and take notes

- Listen to telephone calls and respond; keep notes while listening
- Listening to announcements (railway/bus stations/airport/stadium announcement, etc.)
- Listening to radio and TV
- Common barriers to the listening process.

UNIT II Speaking

- Use conversation starters: Introducing oneself, introducing others, small talk about family, friends, hobbies, profession, studies, etc.
- Use of a dictionary for pronunciation practice
- Summarize academic readings and lectures, and make presentations
- Describe graphs, tables, and charts.
- Describe machines and their functions, e.g. computers and hardware,
- Describing processes, e.g. how to download apps in mobile handsets.
- Ask for and give permission, seek clarification, offer and respond to offers.
- Ask questions and respond to questions politely,
- Congratulate people on their success, apologize.

UNIT III Reading

- Reading comprehension
- Four modes of reading (oral reading to an audience, oral reading to oneself, silent reading, silent reading while listening)
- Pre-/during-/post-reading activities
- Reading to enrich vocabulary
- Skimming through reading texts and determine two or more main ideas or themes
- Scanning through reading texts to understand and explain how key details support the main ideas or themes

UNIT: IV WRITING

- Basic paragraph structure: main idea, supporting sentences, use of examples, conclusion,
- Use basic sentence structures to write a paragraph; use cohesive devices to connect sentences in a paragraph; use transitional devices for cohesion and for contrast paragraph internally and between paragraphs (The above structures and devices to be consciously used in all writing tasks),
- Understand and use text structures in paragraphs: sequencing, comparing and contrasting, relating cause and effect, problems and problem solving
- Write informal letters, applications, and official letters of request and denial
- Write official e-mails, memos and notices

UNIT : V ACTIVITIES ON LSRW

Teacher and student made activities on Listening, Speaking, Reading and Writing

Book Prescribed:

1. Ramesh, M.S. Business Communication. New Delhi: R. Chand & Co. 2003
2. FitzGerald, Helen. Cross Cultural Communication. Melbourne: Hospitality Press. 2002

CO- PSO Articulation Matrix

Course	PSO	PSO	PSO	PSO	PSO	PSO	PSO	PSO	PSO	PSO	PSO1	PSO1	PSO1
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------

Outcome (CO)	1	2	3	4	5	6	7	8	9	0	1	2
CO1	3	2	1	2	2	1	2	1	1	3	2	3
CO2	2	2	2	2	3	1	1	1	2	3	2	3
CO3	3	2	3	1	2	2	1	1	2	3	2	2
CO4	2	2	2	2	3	1	1	1	2	3	2	3
CO5	3	3	3	2	2	2	2	2	2	2	3	2

Possible Levels of Testing based on Bloom's Taxonomy:

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Listening	✓	✓	✓			
Speaking	✓	✓	✓	✓		
Reading	✓	✓	✓	✓		
Writing	✓	✓	✓	✓	✓	✓
Activities on LSRW	✓	✓	✓	✓	✓	✓

Semester	Subject Code	Subject	L	T	P	Total	Credits
III	BCHF233T30	General Chemistry I	4	1	0	5	5

Course Objectives:

- To understand the fundamental concepts and principles in general chemistry.
- To learn the basic principles and applications of metallurgy and powder metallurgy.
- To gain knowledge of carboxylic acids, their preparation, reactions, and derivatives.
- To understand the properties and reactions of nitrogen-containing organic compounds.
- To comprehend the liquid state, liquid crystals, and basic thermodynamics concepts.

Course Outcomes:

By the end of this course, students will be able to:

CO1: Understand and apply the principles of metallurgy and powder metallurgy.

CO2: Identify, name, and describe the preparation and reactions of carboxylic acids and their derivatives.

CO3: Comprehend the properties and reactions of nitrogen-containing organic compounds.

CO4: Explain the properties of liquids and liquid crystals.

CO5: Understand and apply the basic principles of thermodynamics.

Unit I: Principles of Metallurgy & Powder Metallurgy (15 hrs)

1.1 Metallurgy: Definition, principles, and processes -Types of ores and concentration methods: Gravity separation, magnetic separation, froth flotation, leaching. Extraction of metals: Pyrometallurgy, hydrometallurgy, electrometallurgy. Refining of metals: Distillation, liquation, electrolytic refining, zone refining.

1.2 Powder Metallurgy: Definition, advantages, and disadvantages. Steps involved in powder metallurgy: Powder production, compaction, sintering, and secondary operations.

Unit II: Carboxylic Acids (15 hrs)

Nomenclature, structure, and physical properties of carboxylic acids -Preparation of carboxylic acids: Oxidation of primary alcohols, aldehydes, and alkyl benzenes; hydrolysis of nitriles -Reactions of carboxylic acids: Acidity, formation of esters, acid chlorides, amides, and anhydrides- Dicarboxylic acids: Preparation and reactions of oxalic acid, malonic acid, succinic acid. Hydroxy acids: Citric acid and malic acid - structure, properties, and reactions.

Unit III: Nitrogen-Containing Organic Compounds I (15 hrs)

Aliphatic and aromatic nitro compounds: Preparation, properties, and reactions. Reduction of nitro compounds to amines. Amides: Preparation, properties, and reactions. Nitriles: Preparation, properties, and reactions. Hoffmann bromamide degradation reaction. Oximes – preparation properties and reactions-Beckmann rearrangement.

Unit IV: Liquid State and Liquid Crystals (15 hrs)

4.1 Properties of liquids: Surface tension, viscosity, vapour pressure, and boiling point. Structure of liquids.

4.2 Liquid crystals: Definition, types, and applications. Thermotropic and lyotropic liquid crystals. Application of liquid crystals in displays and other technologies.

Unit V: Thermodynamics I (15 hrs)

5.1 Introduction to thermodynamics: Systems, surroundings, and types of systems. Terms used in thermodynamics: State functions, path functions, extensive and intensive properties. Zeroth law of thermodynamics: Concept of temperature and thermal equilibrium.

5.2. First law of thermodynamics: Internal energy, work, heat, and enthalpy. Heat Capacities of gases at constant volume and pressure and their relationship. Joule Thomson Effect, Joule-Thomson coefficient, and inversion temp. Calculation of w , q , dE , and dH for the reversible expansion of ideal gases under isothermal and adiabatic conditions. Application of the first law to various processes: Isothermal, adiabatic, isobaric, and isochoric processes.

Textbooks:

1. Puri, B. R., Sharma, L. R., & Kalia, K. K. *Principles of Inorganic Chemistry*. Vishal Publications, 2020.
2. Silberberg, Martin S. *Principles of General Chemistry*. McGraw-Hill Education, 2017.
3. Chang, Raymond, and Kenneth A. Goldsby. *Chemistry*. McGraw-Hill Education, 2016.
4. Bruice, Paula Yurkanis. *Organic Chemistry*. Pearson Education, 2016.
5. Puri, B. R., Sharma, L. R., & Pathania, M. S. *Principles of Physical Chemistry*. Vishal Publishing Co., 2022.

Reference Books:

1. Chang, Raymond, and Kenneth A. Goldsby. *General Chemistry: The Essential Concepts*. McGraw-Hill Education, 2014.
2. Vollhardt, K. Peter C., and Neil E. Schore. *Organic Chemistry: Structure and Function*. W.H. Freeman, 2018.
3. Angelo, P.C., and R. Subramanian. *Powder Metallurgy: Science, Technology, and Applications*. PHI Learning Pvt. Ltd., 2008.
4. Atkins, Peter, and Julio de Paula. *Physical Chemistry*. Oxford University Press, 2018.

CO-PSO Articulation Matrix:

Course Outcome (CO)	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	2	1	1	1	2	1	1	1	1	1
CO2	3	3	2	1	1	1	2	1	1	1	1	1
CO3	3	2	3	1	1	1	2	1	1	1	1	1
CO4	2	2	2	1	1	1	2	1	1	1	1	1
CO5	3	2	2	2	1	1	2	1	1	1	1	1

3: Strongly aligns, 2: Moderately aligns, 1: Slightly aligns, 0: Does not align

Possible Levels of Testing based on Bloom's Taxonomy:

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Principles of Metallurgy & Powder Metallurgy	✓	✓	✓			
Carboxylic Acids	✓	✓	✓	✓		
Nitrogen-Containing Organic Compounds I	✓	✓	✓	✓		
Liquid State and Liquid Crystals	✓	✓	✓	✓		
Thermodynamics I	✓	✓	✓	✓		

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III		Allied Mathematics-I	4	-	-	4

Course Objectives:

- ❖ To gain knowledge on eigenvalues and eigen vectors
- ❖ To understand expansions of trigonometric functions
- ❖ To know the differentiation of hyperbolic functions and successive differentiation
- ❖ To understand partial differentiation and apply Euler's theorem
- ❖ To acquire knowledge about solving algebraic and transcendental equations numerically

Course Outcomes:

At the end of the course, students will be able to

1. Compute eigenvalues and eigenvectors
2. To expand trigonometric functions
3. To solve algebraic and transcendental equations using numerical methods
4. To find the n th order derivative of functions
5. To apply Euler's theorem on partial differentiation

Unit I: Matrices

Introduction - Symmetric - Skew-Symmetric - Conjugate of a matrix - Hermitian and Skew-Hermitian - Orthogonal and Unitary matrices (only definition) - Rank of a matrix - Condition for consistency - Cayley-Hamilton theorem (without proof) - Verification and computation of inverse matrix - Eigen roots and eigenvectors.

Unit II: Trigonometry

Expansion of $\sin x$, $\cos x$, $\tan x$, $\sin^n x$, $\cos^n x$, $\tan^n x$ - Expansion of $\sin x$, $\cos x$, $\tan x$ in terms of x - Hyperbolic and inverse hyperbolic functions - Simple problems.

Unit III: Successive Differentiation

Successive Differentiation - n th order derivatives of standard functions - Leibnitz theorem (without proof) - Simple problems.

Unit IV: Partial Differentiation

Partial differentiation - Partial derivative - Higher derivative - Homogeneous function - Euler's theorem on homogeneous functions - Problems on Euler's theorem.

UnitV:SolutionofAlgebraicandTranscendentalEquations

Solution of algebraic and transcendental equations - Bisection method - Method of falseposition - Newton–Raphson method - Solution of linear simultaneous equations - Gausseliminationmethod-GaussJordanmethod-Gauss Seidalmethod.

PrescribedTextbooks:

1. P.R.Vittal. Allied Mathematics, Margham Publications Third Edition, Chennai.UnitI– Chapter 5 UnitII– Chapter 14
UnitIII–Chapter8UnitIV–Chapter9
2. P.Kandasamy,Dr.K.Thilagavathy,Dr.K.Gunavathi,NumericalMethods,S.ChandandCompanyLtd., ThirdRevised Edition, New Delhi.
UnitV(Chapter3.1-3.4, 4.1-4.3&4.9)

References:

1. B.S.Grewal,HigherEngineeringMathematics,KhannaPublishers,NewDelhi.
2. S.Arumugamandco.,Basic Mathematics for Engineering, ScitechPublications,Chennai,2013.
3. T.Veerarajan,EngineeringMathematics(ForFirstYear)TataMcGrawHill,SecondEdition.
4. Dr.M.K.Venkataramanan,NumericalMethodsInScienceandEngineering,TheNationalPublishingCompany, Chennai.

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	BCHF233T4B	Allied Computer Science-I	2	-	1	3

CO

URSE OBJECTIVES

- To help the students to learn programming concepts using C Language
- To learn the fundamentals of PST and methodologies which are essential for building good C programs
- To demonstrate a thorough understanding of modular programming by designing programs which require the use of programmer-defined functions
- To impart the knowledge about pointers which is the backbone of effective memory handling
- To demonstrate adopt of file access in developing solutions to problems.

COURSE OUTCOMES

- Learn the fundamental programming concepts and methodologies which are essential for building good C programs.
- Understand the modular programming by designing programs which require the use of programmer defined functions.
- Acquire the knowledge about pointers
- Learn about the Storage Classes and building good C programs.
- Obtain the knowledge of writing programs for file access.

UNIT – I

C fundamentals: Character set - Identifier and keywords - data types - constants- Variables - Declarations - Statements - Operators – Expressions.

12

UNIT – II

Data input and output functions: - Simple C programs - Flow of control - if, if else, While, do-while, for loop, Nested control structures - Switch, break and continue, go to statements.

12

UNIT – III

Functions:-Definition - prototypes - Passing arguments – Recursion- Storage Classes - Automatic, External, Static, Register Variables

12

UNIT – IV

Arrays: - Defining and Processing - Passing arrays to functions - Arrays and Strings. Structures and unions - Passing structures to functions - Unions - Bit wise operations.

12

UNIT – V

Pointers: - Declarations - Passing pointers to Functions - Pointer and Arrays -Arrays of Pointers - Structures and Pointers - Files: Creating, Processing, Opening and Closing a data file.

12

TOTAL: 60

TEXT BOOKS:

1. Henry Mullish, Herbert Cooper, The Spirit of C An Introduction to Modern Programming, Jaico Publishing House, 28th Impression, 2006.
2. Yashavant P. Kanetkar, Understanding Pointers In C , BPB Publications, New Delhi, 14th Edition, 2016

REFERENCE BOOK:

1. Byron C Gotfried, Programming with C, Schuams' outline series, 3rd Edition, Tata McGraw Hill Education, 2017.

Semester	Subject Code	Subject	L	T	P	Total	Credits
III	BCHF233P60	Major Lab-III Qualitative Inorganic Analysis	0	0	0	3	3

Course Objectives:

1. To understand the principles of semi-micro analysis in inorganic chemistry.
2. To learn the systematic identification of cations and anions in complex mixtures.
3. To develop skills in conducting semi-micro analysis experiments.
4. To interpret and analyze experimental results to deduce the composition of unknown samples.
5. To apply semi-micro analysis techniques to real-world scenarios.

Learning Outcomes:

By the end of this course, students should be able to:

- CO1:** Identify cations and anions in complex mixtures using semi-micro analysis techniques.
- CO2:** Perform semi-micro analysis experiments accurately and safely.
- CO3:** Analyse experimental data and draw conclusions about the composition of unknown samples.
- CO4:** Apply semi-micro analysis techniques to practical situations in chemistry.

Semi micro inorganic analysis:

- Analysis of a mixture containing two cations and two anions of which one will be an interfering ion.
- Combination of salts forming insoluble precipitates should be avoided.
- Semi micro methods using the conventional scheme with hydrogen sulphide may be adopted.
- Cations to be studied: lead, copper, bismuth, cadmium, iron, aluminum, zinc, manganese, cobalt, nickel, barium, calcium, strontium, magnesium and ammonium.
- Anions to be studied: Carbonate, Sulphate, nitrate, chloride, fluoride, borate, oxalate, and phosphate.

Reference Books:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)
2. R.Mukhopadhyay,P.Chatterjee.,Advanced Practical Chemistry,3rd edition,Arunabha SenBooks & Allied Pvt,Ltd. (2007)
3. V.V. Ramanujam, Inorganic semi micro qualitative analysis, 3rd edition, The National publishing company, (1974)
4. Gurdeep Raj, Advanced Practical Inorganic Chemistry,15th edition,(2001)

Scheme of Valuation	
Record	10 marks
Procedure & Analysis	70 marks
a) Acid radicals	$2 * 15 = 30$
b) Group separation	10
c) Basic radicals	$2 * 15 = 30$
Result	10 marks
Viva	10 marks
Total	100 mark

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	BCHF233P70	Allied Computer Science lab-1	-	1	1	3

CO

URSE OBJECTIVES

- To be able to get trained in programming skills using C
- To help the students to write the programs using conditional Statements and Lopping Statements.
- To learn and write the programs for Array and structure.
- To learn about the usage of functions.
- To impart the knowledge about pointers, files and effective memory handling

COURSE OUTCOMES

- Ability to implement application programs using C Language
- Able to implement structure and functions concepts
- Understand various string functions
- Knowledge on implementing the concepts of Pointers
- Create and use of the file operations.

LIST OF EXERCISES

1. Write a Program to generate a Fibonacci Series
2. Write a Program to Check Whether a Number is Prime or not
3. Write a Program to count the number of positive, negative and 0 values switch case statement.
4. Write a Program to check whether the given string is palindrome or not.
5. Write a Program to print the given number in the reverse order using WHILE loop.
6. Write a Program to sort an array.
7. Write a Program to add two matrices.
8. Write a Program to multiply of two matrices.
9. Write a Program to sort the array of names.
10. Write a Program to find the factorial of an integer using recursion.
11. Write a Program to swap two values using function.
12. Write a Program to perform read and write operation on a file.

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	ICSF233T80	Yoga	1	-	-	1

OBJECTIVES OF THE COURSE:

- To impart the students with basic concepts of Yoga for health and wellness.
- To familiarize the students with health-related Exercise and Yoga for Overall growth and development
- To create a foundation for the professionals in Physical Education and Yoga.
- To impart the basic knowledge and skills to teach Yoga activities.

LEARNING OUTCOME / SKILLS:

- Students will be able to understand the basic principles and practices of Yoga.
- Students will be able to instruct Yoga practices for Healthy Living.
- To develop professionalism among students to conduct, organize Yoga events at schools and community level.

Syllabus

INTRODUCTION TO YOGA

1. Basic Principles of Yogic practices
2. Word meaning and definitions of Yoga
3. Different schools of Yoga
4. Mithahara, PathyaApatyha in Yogabhyasa.
5. Ashtanga Yoga
6. ShitalikarnaVyayama / Physical Cultural Exercises
7. Introduction to Pranayama
8. Yoga to enhance memory and concentration.

PRACTICAL DEMONSTRATION OF YOGA

1. ShitalikarnaVyayama / Physical Cultural Exercises
2. Suryanamaskara
3. Standing Asanas- Ardchakrasana, Padahasthasana, Ardhakatichakrasana, Trikonasana.
4. Sitting Asanas – Paschimottasana, Bhadrasana, Vakrasana, Vajrasana.
5. Prone posture Asanas – Makarasana, Bhujangasana, Shalabhasana, Dhanurasana.

6. Supine posture Asanas – Ardha pavana Mukthasana, Purna Pavana Mukthasana, Sethubhandasana, Uttanapadasana.

7. Pranayama- Nadishodhana Pranayama, Bhastrika Pranayama, Bramari Pranayama.

8. Dhyana – Shavasana.

Semester	Subject Code	Subject	L	T	P	Total	Credits
III	BCHF233T50	Introduction to IKS-1	2	0	0	5	2

Course Objectives:

- To introduce foundational concepts of Indigenous Knowledge Systems, focusing on the Vedic corpus and Indian philosophical traditions.
- To explore the linguistic structure of Sanskrit and its influence on scientific and technological thought.
- To study the Indian number system, including the concept of zero and its contributions to mathematics.
- To analyze ancient Indian science and technology, including innovations in gravity, metallurgy, and laboratory practices.
- To understand Rasasastra, differentiating it from alchemy, and exploring its relevance to modern technology.

Course Outcomes:

By the end of this course, students will be able to:

- **CO1:** Explain the significance of IKS, including Vedic texts and Indian philosophical traditions.
- **CO2:** Analyze Sanskrit linguistics and its application in scientific terminology.
- **CO3:** Describe the evolution of the Indian number system and the importance of zero.
- **CO4:** Evaluate ancient Indian scientific and technological advancements and their modern relevance.
- **CO5:** Differentiate Rasasastra from alchemy and assess its impact on modern technology.

Unit-I: Introduction to IKS

Introduction, Definition, Importance of IKS, Classification of IKS Corpus- Sanatanadharma, other Dharmic traditions, The need for IKS, Historicity of IKS. The vedic corpus- Introduction of vedas, the four vedas & its divisions, Indian philosophical systems- development & unique features. Puranas- maha, upa and sthala- key characteristics of puranas, Ithihasa- Messages from Ramayana, Mahabharatha- a source for worldly wisdom.

Unit-II Foundational concepts for Science & Technology

Linguistics-components of a language, phonetics in Sanskrit, word patters in sanskrit language, rule based grammatical operations, Algorithm for compound work, Importance of verbs, Logic for sentence construction.

Unit-III Number system & Units of measurement

Number system in India-Historical evidence, salient features of Indian number system, the concept of zero and its importance, large numbers and their representation, Unique aspects of Indian mathematics, contributions of great Indian mathematicians(in brief).

Unit-IV Science & Technology

Science & technology in ancient India: Introduction and importance of IKS in science, Contribution of ancient Indian scientist in science and technology, Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Laboratory and Apparatus, Dyes, Paints and Metallurgy.

Unit-V Rasasastra

Introduction to rasasastra, Differences between alchemi and rasasastra, RASA- types- dhatu-types, Radna, visa, Ancient texts in rasasastra, different samaskara, Distillation, Zinc smelting, Dyeing, perfumeries, Soap, glass.relevance in modern technology.

Textbooks:

1. Mahadevan, B., Nagendra Pavana, and Vinayak Rajat Bhat. *Introduction to Indian Knowledge System: Concepts and Applications*. Delhi PHI Learning Pvt. Ltd., 2022. ISBN 9789391818203.
2. Kapoor, Kapil, and Avadhesh Kumar Singh. *Indian Knowledge Systems*. D.K. Printworld (P) Ltd., 2005. ISBN 978-8124603159.

Reference Books:

1. Saraswati, Swami Dayananda. *Vedic Heritage Teaching Programme*. Arsha Vidya Gurukulam, 2002. ISBN 978-8187326117.
2. Srinivasan, M.K. *Science in Samskrit*. Samskrita Bharati, 2004. ISBN 978-8187276337.
3. Rahman, A. *History of Indian Science, Technology, and Culture*. Oxford University Press, 1999. ISBN 978-0195646528.
4. Narayana, Dr. D. B. A. *Rasasastra: The Science of Mercury in Ayurveda*. Chaukhambha Orientalia, 2000. ISBN 978-8176370668.

CO-PSO Articulation Matrix

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	2	1	1	2	1	1	2	2	2	2	2
CO2	2	3	2	1	2	1	2	2	2	2	2	2

CO3	3	2	2	1	3	1	2	3	2	2	2	2
CO4	2	3	2	2	3	2	3	2	3	3	2	3
CO5	1	2	3	2	3	2	3	3	3	3	2	3

Bloom's Taxonomy Levels for Indigenous Knowledge Systems (IKS) Topics

Unit	Remember (K1)	Understand (K2)	Apply (K3)	Analyze (K4)	Evaluate (K5)	Create (K6)
Introduction to IKS	✓	✓	✓	✓		
Foundational Concepts for Science & Technology	✓	✓	✓	✓		
Number System & Units of Measurement	✓	✓	✓	✓		
Science & Technology	✓	✓	✓	✓	✓	
Rasasastra	✓	✓	✓	✓	✓	

Semester-IV

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	CLTS234T10	Tamil -IV	3	-	1	3

Objective-1	பக்தி இலக்கியம் பக்தி இலக்கியங்கள் வழி சமயச் சான்றோர்களின் கருத்துக்களை உணர்த்துதல்
Objective-2	சங்க இலக்கியம் தமிழர்களின் அகப்புற கோட்பாடுகளை சங்க இலக்கியத்தின் வாயிலாக கற்றுக் கொடுத்தல். தமிழர்களின் வீரம் கொடை அறம் சார்ந்த நிகழ்வுகளை ஊடகங்கள் வழி பதிவு செய்தல்
Objective-3	உரைநடை இலக்கணமும் மொழித் திறனும் மொழியை பிழையின்றி பேச எழுத கற்க தேவையான தமிழ் இலக்கணத்தின் இன்றியமையாமையை உணர்த்துதல்
Objective-4	பயண நூல் (வழி காட்டி பயண நூல்களில் வாயிலாக ஒரு ஊரின் முக்கிய சிறப்புகளையும் முக்கிய இடங்களையும் தலைவர்களையும் எடுத்துரைத்தல்
Objective-5	மனித உரிமைகள் தனி மனிதன் உரிமைகள் பற்றிய மாணவர்களை அறியச் செய்தல் பெண்ணுரிமை பற்றியும் மனிதர்களுக்கான ஒவ்வொரு உரிமைகளை தெரிந்து கொள்ளுதல் நோக்கமாகும்

OUTCOMES:

On the successful completion of the course, students will be able to

CO Number	CO Statement
CO -1	பக்தி இலக்கியம் பக்தி இலக்கியங்கள் வழி பக்தி நெறிகளை உணர்ந்து கொள்ளுதல்
CO -2	சங்க இலக்கியம் தமிழர்களின் அகப்புறக் கோட்பாடுகளை அறிந்து கொண்டு ஏதேனும் ஒரு ஊடகத்தின் வழி தான் கற்றவற்றை வெளிப்படுத்துதல்
CO -3	உரைநடை மாணவர்கள் தங்கள் வாசிப்பு திறனை மேம்படுத்தி தமிழினை தங்கு தடை இன்றி படித்தல்
CO -4	பயண நூல் (வழி காட்டி ஒரு ஊரின் முக்கிய சிறப்புகளையும் முக்கிய இடங்களையும் தலைவர்களையும் சிறப்பினை அறிந்து போற்றுதல்
CO-5	மனித உரிமைகள்

மனித உரிமை பற்றிய புரிதல் மனித உரிமை ஆணையம் குறித்து அறிதல் ஒவ்வொரு மனிதர்களும் தனக்கான உரிமையை அறிந்து கொள்ளுதல்

அலகு 1 சங்க இலக்கியம்

தமிழகத்தின் தாவரங்களுக்கும் விலங்குகளும், தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள், தமிழர்கள் போற்றிய அறக்கோட்பாடு, சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி, சங்ககாலத்தில் தமிழர்களின் எழுத்தறிவும் கல்வியும், வீரம் கொடை அறம் சார்ந்த நிகழ்வுகளின் காட்சி பதிவு - திரைப்படம், தொலைக்காட்சி, வானொலி, இதழ்கள் திட்டம் (PROJECT)

அலகு 2 உரைநடை

சங்க நெறிகள் முனைவர் வ.சு.ப மாணிக்கம் - தமிழர் பண்பாடு ஒரு விளக்கம் - டாக்டர் சோ. நா. கந்தசாமி விருந்தோம்பல் நேற்று இன்று நாளை சரளா ராஜ கோபாலன்

அலகு 4 பயண நூல் (வழி காட்டி)

காஞ்சிபுரம் ஒரு தரிசன வழிகாட்டி கோவில்கள் - மடங்கள் - புகழ் பெற்ற இடங்கள்

அலகு 5 மனித உரிமைகள்

மனித உரிமை பற்றிய புரிதல் - மனித உரிமை வரலாறு பண்புகளும் அறிதல் - ஒவ்வொரு மனிதர்களும் உள்ள உரிமைகளைத் தெரிந்து கொள்ளுதல்- குழந்தைகளின் உரிமைகள் - கொத்தடிமைகள் - பெண் உரிமை

பாடநூல் :-

1. தெய்வத்தின் குரல் தொகுப்பாசிரியர் ரா கணபதி வானதி பதிப்பகம் சென்னை -17
2. தமிழக வரலாறு மக்கள் பண்பாடு கேகே பிள்ளை தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் கழகம்
3. வகைமை நோக்கி தமிழ் இலக்கிய வரலாறு, பாக்கிய மேரி, நியூ செஞ்சுரி புக ஹவுஸ் சென்னை
4. சங்க இலக்கியம் பாரிநிலையும் சென்னை 108
5. காஞ்சிபுரம் ஒரு தரிசன வழிகாட்டி தங்கத்தாமரை பதிப்பகம் அடையாறு சென்னை 20
6. கீழடி வைகை நதிக்கரையில் சங்க கால நாகரிகம் தொல்லியல் துறை வெளியீடு
7. முனைவர் . ஜெ. தியாகராஜன் மனித உரிமைகள் நிர்மலா பதிப்பகம் மதுரை -1

பார்வை நூல் :-

1. தமிழ் இலக்கியங்களில் வாழ்வியல் சிந்தனைகள் பல்லவி பதிப்பகம் ஈரோடு-11

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	CLES234T20	English –IV	3	-	1	3

Ob

Objectives:

1. To comprehend the significance of communication and its purpose
2. To listen actively, speak clearly and using proper language in telephone conversation.
3. To apply effective communication skills in a variety of public and interpersonal settings
4. To build the professional skills needed for career development and to present it effectually and ethically.
5. To utilize the strategies of Verbal and Nonverbal communication in various facets of presentation

Course Outcomes:

Students will be able to:

- Understand the importance of communication and its techniques
- Use proper language and speak convincingly and pleasingly.
- Interact proficiently and ethically
- Present professional skills in an effectual way.
- Apply the essential components of a presentation.

Unit-I: COMMUNICATION

Communication: Meaning, Nature, Importance and Purpose of Communication, Types of Communication, Process of Communication, Communication Network in an Organization, Strategy for Effective Communication, Verbal and Non- Verbal Communication, Barriers to Communication, Essentials of Good Communication, Communication Techniques.

Unit II: TELEPHONIC SKILLS

Basics of telephone communication, how to handle calls- telephone manners, leaving a message, making requests, greeting and leave taking over phone(etiquette), asking for and giving information, giving instructions, listening for tone/mood and attitude at the other end handling the situations especially trouble shooting, teleconference handling, handling Tele interviews for Call Centers

Unit III: EFFECTIVE COMMUNICATION

Making enquiry & requests, Answering general questions, railway enquiry, looking for accommodation, asking about a course, asking for & giving directions.

Unit IV: CAREER SKILLS

Applying for job, Cover letters, Resume and Effective Profiling, Interviews, Group discussions. Importance and Factors Involving Job Interview; Characteristics of Job Interview; Job Interview Process; Job Interview Techniques- Manners and etiquettes to be maintained during an interview; Sample Questions Commonly asked During Interview

Unit V: PRESENTATION SKILLS

Presentation Skills, Interviews, Public Speaking, Preparing a Speech, Organizing the Speech, Special Occasion Speeches, self-introduction.

Books Prescribed:

1. Kavita Tyagi, Padma Misra. Professional Communication. New Delhi: PHI Learning Pvt. Ltd. 2011

CO- PSO Articulation Matrix

Course Outcome (CO)	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PSO1 2
CO1	3	2	2	2	2	2	2	1	1	3	2	3
CO2	2	2	2	1	2	1	2	1	2	3	2	3
CO3	3	2	2	3	2	2	2	2	2	3	2	3
CO4	3	2	3	3	2	2	2	1	2	3	3	3
CO5	2	2	3	2	2	2	2	1	2	3	3	3

Possible Levels of Testing based on Bloom’s Taxonomy:

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Communication	✓	✓	✓	✓		
Telephonic Communication	✓	✓	✓	✓		
Effective Communication	✓	✓	✓	✓		
Career Skills	✓	✓	✓	✓	✓	
Presentation Skills	✓	✓	✓	✓	✓	✓

	Subject Code	Subject	L	T	P	Total	Credits
Core	BCHF234T30	General Chemistry II	4	1	0	5	5

Course Objectives:

- To understand the chemistry of d and f block elements and their applications.
- To gain knowledge of inorganic solids and their properties.
- To comprehend the properties and reactions of amines and other nitrogen-containing organic compounds.
- To understand the fundamentals of quantum mechanics and its applications in chemistry.
- To learn about LASERs and photochemistry and their practical applications.

Course Outcomes:

By the end of this course, students will be able to:

CO1: Explain the chemistry and applications of d and f block elements.

CO2: Understand the structure, properties, and applications of inorganic solids.

CO3: Describe the preparation, properties, and reactions of amines and organic nitrogen compounds.

CO4: Understand the basic principles and postulates of quantum mechanics.

CO5: Explain the principles of LASERs and photochemistry and their applications.

Unit I: d and f Block Elements (15 hrs)

1.1 General properties of d block elements: Electronic configuration, oxidation states, and trends in properties. Group study of Ti, V, Cr, and Cu groups.

1.2 General properties of f block elements: Lanthanides and actinides, electronic configuration, oxidation states, and trends in properties. Lanthanide contraction: Causes and consequences. Methods of separation of lanthanides Actinides –general properties- applications. Magnetic and spectral properties of lanthanides and actinides.

Unit II: Inorganic Solids (15 hrs)

2.1 Types of solids: Ionic, covalent, metallic, and molecular solids- Crystal lattices and unit cells: Types of unit cells, packing efficiency, and density calculations- Crystal defects: Point defects, line defects, and plane defects.

2.2 Electrical properties of solids: Conductors, semiconductors, and insulators. Magnetic properties of solids: Diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, and ferrimagnetism - Superconductivity: Basic principles and applications.

Unit III: Organic Nitrogen-Containing Compounds II (15 hrs)

3.1 Aliphatic Amines: Classification, nomenclature, preparation, and physical properties. Reactions of amines: Basicity, acylation, carbylamine reaction. Polyamines: Preparation, properties, and uses of ethylenediamine and other polyamines.

3.2 Aromatic amines: Preparation, properties, and reactions with special reference to diazotization, and coupling reactions. Polyaniline- preparation, properties, and uses. Phenylene diamines: Preparation, properties, and applications- Diphenylamine.

Unit IV: Quantum Mechanics I (15 hrs)

4.1 Inadequacies of classical mechanics: Blackbody radiation, photoelectric effect, and Compton Effect.

4.2 Formulation of quantum mechanics: Wave-particle duality, de Broglie hypothesis, and Heisenberg uncertainty principle - Schrödinger equation: Derivation and significance - Postulates of quantum mechanics: Wave function, probability density, and operators.

Unit V: LASERs and Photochemistry (15 hrs)

5.1 LASERs: Principles, types, and applications - Characteristics of LASER light: Coherence, monochromaticity, and directionality.

5.3 Photochemistry: Laws of photochemistry, quantum yield, and photochemical reactions - Jablonski diagram: Fluorescence, phosphorescence, and non-radiative processes - Applications of photochemistry: Photochemical synthesis, photosensitization, and photodynamic therapy.

Textbooks:

1. Inorganic Chemistry, Gary L. Miessler, Paul J. Fischer, Donald A. Tarr, Pearson, 2014.
2. Organic Chemistry, Paula Yurkanis Bruice, Pearson, 2016.
3. Physical Chemistry, Peter Atkins, Julio de Paula, Oxford University Press, 2018.
4. Quantum Chemistry, Ira N. Levine, Pearson, 2014.
5. Photochemistry and Photophysics: Concepts, Research, Applications, Jan Kopecky, Springer, 2013.

Reference Books:

1. Advanced Inorganic Chemistry, F. Albert Cotton, Geoffrey Wilkinson, Paul L. Gaus, Wiley, 1999.
2. Organic Chemistry: Structure and Function, K. Peter C. Vollhardt, Neil E. Schore, W.H. Freeman, 2018.
3. Introduction to Quantum Mechanics, David J. Griffiths, Pearson, 2015.
4. Fundamentals of Photochemistry, K. K. Rohatgi-Mukherjee, New Age International, 2011.
5. Solid State Chemistry: An Introduction, Lesley E. Smart, Elaine A. Moore, CRC Press, 2012.

CO-PSO Articulation Matrix:

Course Outcome (CO)	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	2	1	1	1	2	1	1	1	1	1
CO2	3	2	2	1	1	1	2	1	1	1	1	1
CO3	3	3	2	1	1	1	2	1	1	1	1	1
CO4	3	2	2	1	1	1	2	1	1	1	1	1
CO5	3	2	2	1	1	1	2	1	1	1	1	1

3: Strongly aligns, 2: Moderately aligns, 1: Slightly aligns, 0: Does not align

Possible Levels of Testing based on Bloom's Taxonomy:

Unit	Remember (K1)	Understand (K2)	Apply (K3)	Analyze (K4)	Evaluate (K5)	Create (K6)
d and f Block Elements	✓	✓	✓			
Inorganic Solids	✓	✓	✓	✓		
Organic Nitrogen Compounds II	✓	✓	✓	✓		
Quantum Mechanics I	✓	✓	✓	✓		
LASERS and Photochemistry	✓	✓	✓	✓		

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV		Allied Mathematics-II	4	-	-	4

Course Objectives:

- ❖ To understand general term in a binomial expansion; to find a specific term (or its coefficient) in binomial, exponential and logarithmic series.
- ❖ To evaluate summation of series.
- ❖ To understand the concepts of differential equation and classify the type based on order and linearity.
- ❖ To study about finite differences, interpolation and numerical integration.
- ❖ To classify types of integral and evaluate.

Course Outcomes:

At the end of the course, the students will be able to

1. Find a particular term in binomial, exponential and logarithmic expansion.
2. Identify the type of infinite series and evaluate.
3. Solve first-order ordinary differential equations and use the operator method to solve linear systems with constant coefficients.
4. To find value of y for any value of x , from the given set of values.
5. To apply numerical methods to evaluate differentiation and integration.
6. To evaluate definite and indefinite integrals.

Unit I: Summation of Series

Partial fractions - Resolution into partial fractions - Binomial series - Binomial theorem for arational index (without Proof)- Summation of binomial series - Exponential series - Standard results for exponential series - Logarithmic series (without Proof) - Summation - Simple problems.

Unit II: Ordinary Differential Equations

Second order differential equations with constant coefficients - Linear operator - Solution for non-homogeneous differential equations - Methods of obtaining particular integral.

Unit III: Definite and Indefinite Integrals

Integration of rational algebraic functions - Integration of irrational algebraic functions

- Properties of definite integrals

$$\int \frac{px+q}{ax^2+bx+c} dx \quad \int \frac{px+q}{\sqrt{ax^2+bx+c}} dx \quad \int \frac{1}{px+q\sqrt{ax^2+bx+c}} dx$$

$$\int \frac{1}{a+b\cos x} dx \quad \int \frac{1}{a+b\sin x} dx \quad \int \frac{1}{l\cos x+m\sin x+n} dx$$

$$\int_0^{\pi} \sin^n x dx \quad \int_0^{\pi} \cos^n x dx$$

Unit IV: Interpolation

Finite differences - Interpolation - Newton's forward difference formula (without proof) - Newton's backward difference formula (without proof) - Divided differences - Interpolation with unequal intervals - Newton's divided difference formula (without proof) - Lagrange's formula - Inverse Interpolation.

Unit V: Numerical Differentiation and Integration

Numerical Differentiation - Newton's Forward Interpolation Formula to compute derivative - Newton's Backward Interpolation Formula to compute derivative - Numerical Integration - Trapezoidal Rule; Simpson's 1/3rd Rule; Simpson's 3/8th Rule.

Prescribed Textbooks:

1. P.R. Vittal. Allied Mathematics, Margham Publications, Chennai. Unit I - (Chapter 1-4)
Unit II (Chapter 23)
Unit III (chapter 15, 16)
2. P. Kandasamy, Dr. K. Thilagavathy, Dr. K. Gunavathi, Numerical Methods, S. Chand and Company Ltd., Third Revised Edition, New Delhi.
Unit IV 6.1-6.38, 1, 8, 2, 8.5, 8.7
Unit V 9.1-9.3, 9.7, 9.9, 9.13, 9.14

References:

1. S.Narayanan, T.K Manicavachagom Pillai, Calculus Volume II,S.Chand andCompanyLtd.Chennai,
2. Dr.M.K.Venkataramanan, Numerical Methods in Science and Engineering, TheNationalPublishingCompany, Chennai.

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	BCHF234T4B	Allied Computer Science-II	2	-	1	3

3. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.

COURSE OBJECTIVES

- To introduce the basic concepts of Object Oriented Programming.
- To acquire knowledge on C++ functions.
- To become aware of significant classes and Objects.
- To impart knowledge on inheritance and polymorphism concepts in C++.
- To explore various file I/O Operations.

COURSE OUTCOMES

- Understand the basic concepts and need of Object oriented programming.
- Explain the various keywords and Tokens in C++.
- Describe the various class concepts in C++.
- Explain the basic principles of inheritance and polymorphism
- Examine the various file I/O operations.

UNIT - I

Introduction to C++ - Principles Of Object Oriented Programming (OOP) – Basic Concepts of OOP - Benefits of OOP – Applications of OOP – Tokens – Keywords – Identifiers – Variables – Operators – Manipulators - Expressions.

12

UNIT - II

Decision Making Statements – Looping Statements - Functions - Main Function - Function Prototyping – Passing Parameters to Functions - Values Return by Functions – Inline Functions - Friend Functions.

12

UNIT - III

Classes and Objects - Constructors and Destructors - Types of Constructor - Inheritance – Types of Inheritance – Function Overloading - Operator Overloading.

12

UNIT - IV

Pointers - Virtual Functions and Polymorphism - Managing Console I/O operations - Templates

Introduction – Function templates

12**UNIT – V**

Working with Files – Classes for File Stream Operations – Opening and Closing of a File –

Updating a File - End of File Deduction.

12**TOTAL: 60****TEXT BOOKS:**

1. Herbert Schildt(2017), "C++ Complete Reference", Fourth edition, TMH,
2. Bjarne Stroustrup, (2013)“The C++ programming language”, Addison Wesley,
3. Balaguruswamy, “Programming in C++”, 5th Edition, Tata McGraw Hill Education Private Limited, 2011.

REFERENCE BOOKS:

1. Paul J.Deitel , Harvey M.Deitel, “C++: How To Program”, Prentice Hall, 2010
2. Robert Lafore, “Object Oriented programming Using C++”. Waite’s Group, 1999.

	Subject Code	Subject	L	T	P	Total	Credits
Core	BCHF234P50	Organic and Gravimetric Analysis	0	0	0	3	3

ORGANIC ANALYSIS

Analysis of Simple Organic compounds (a) characterization of functional groups (b) Confirmation by preparation of solid derivatives / characteristic colour reactions. Note : Mono – functional compounds are given for analysis. In case of bi-functional compounds, students are required to report any one of the functional groups.

ORGANIC PREPARATION:

Preparation of Organic Compounds (Any four)

1. Benzoic acid from benzaldehyde
2. para-bromoacetanilide from acetanilide
3. paranitroacetanilide from acetanilide
4. Phenylazo-2-naphthol from aniline
5. Salicylic acid from methyl salicylate
6. Osazone from glucose.

GRAVIMETRIC ANALYSIS

1. Estimation of Lead as lead chromate.
2. Estimation of Barium as barium chromate
3. Estimation of Barium as barium sulphate.
4. Estimation of sulphate as barium sulphate.
5. Estimation of Barium as barium chromate.
6. Estimation of Calcium as Calcium carbonate.
7. Estimation of Calcium as Calcium oxalate.
8. Estimation of Nickel as Nickel-DMG.

Reference Books:

1. Venkateswaran V., Veerasamy R., Kulandaivelu A.R., Basic principles of practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)
2. R. Mukhopadhyay, P. Chatterjee., Advanced Practical Chemistry, 3rd edition, Arunabha Sen Books & Allied Pvt. Ltd. (2007)
3. Gurdeep Raj, Advanced Practical Inorganic Chemistry, 15th edition, (2001)
4. N.S. Gnanaprasam, G. Ramamurthy, Organic chemistry lab manual, 1st edition, S. Viswanathan printers and publishers Pvt. Ltd. (2006)
5. Jagmohan, Organic, Analytical chemistry, theory and practice. Narose publishing House. (2006)
6. Gnanaprakasam, Ramamurthy, Organic chemistry lab manual.

Scheme of Valuation	
Record	10 marks
Procedure Writing	20 marks
Experiment	30 marks
Calculation	20 marks
Results	10 marks
< 4 % - 10 marks	
6 % - 8 marks	
8 % - 6 marks	
10% - 4 marks	
> 10% - 2 marks	
Viva	10 marks
Total	100 marks

Scheme of Valuation	
Record	10 marks
Organic preparation	30 Marks

Crude sample	20
Recrystallized sample	10
Org. analysis	50 marks
Aromatic/ Aliphatic (05 marks)	05
Sat/Unsat (05 marks)	05
Elements (10 marks)	10
Functional group (10 marks)	10
Derivatives (10 marks)	10
Procedure (20 marks)	20
Viva	10 marks
Total	100 marks

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	BCHF234P70	Allied Computer Science Lab-II	1	-	-	1

COURSE OBJECTIVES

- To introduce the basic concepts of Object Oriented Programming.
- To acquire knowledge on C++ functions.
- To become aware of significant classes and Objects.
- To impart knowledge on inheritance, polymorphism concepts in C++.
- To explore various file I/O Operations.

COURSE OUTCOMES

- Able to solve basic concepts of Object oriented programming.
- Ability to solve the problems using various conditional and branching statements.
- Apply the concept of class and constructors.
- Develop the application to describe polymorphism
- Develop the application to read and write file.

LIST OF EXERCISES

1. Write a C++ Program to generate the pyramid of digits.
2. Write a C++ Program to Generate Armstrong numbers up to a specific limit.
3. Write a C++ Program to Generate Fibonacci series up to n ($n < 50$) number.
4. Write a C++ Program to Reversal of a String using recursion.
5. Write a C++ Program to Construct a class for storage of dimensions of circle, triangle and rectangle and calculate their areas.
6. Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor.
7. Write a C++ Program to Illustrate Multiple inheritance.
8. Write a C++ Program to Illustrate Function overloading.
9. Write a C++ Program to Overload Unary operator.
10. Write a C++ Program to Copy a text file to another.

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	BCCHF234180	Indian Constitution	1	-	-	1

Course Objectives:

1. To provide a basic understanding of the Indian Constitution and its significance.
2. To familiarize students with the fundamental rights, duties, and directive principles enshrined in the Constitution.
3. To analyze the framework of the government and its functioning at different levels—central, state, and local.
4. To understand the constitutional amendments and their relevance in contemporary governance.
5. To foster an appreciation for the role of the Constitution in maintaining democracy and social justice.

Course Outcomes:

After successful completion of the course, students will be able to:

1. **CO1:** Demonstrate an understanding of the historical background and development of the Indian Constitution.
2. **CO2:** Explain the structure and key features of the Indian Constitution, including fundamental rights, duties, and directive principles.
3. **CO3:** Analyze the roles and responsibilities of the executive, legislature, and judiciary within the constitutional framework.
4. **CO4:** Evaluate the impact of constitutional amendments and their role in shaping modern governance.
5. **CO5:** Apply constitutional principles in understanding contemporary political, social, and legal issues in India.

Unit-Wise Course Content:

Unit 1: Historical Background of the Indian Constitution (3 Hours)

- Introduction to the Indian Constitution.
- Historical context and constitutional developments from 1858 to 1947.
- The Constituent Assembly: its composition, objectives, and functions.
- Drafting of the Constitution and the role of Dr. B.R. Ambedkar.

Unit 2: Key Features of the Indian Constitution (3 Hours)

- Preamble and its significance.
- Salient features of the Constitution: Sovereignty, Secularism, Democracy, and Federalism.
- Fundamental Rights and Duties: Significance and scope.
- Directive Principles of State Policy and their role in governance.

Unit 3: Structure of Government (3 Hours)

- The Union and its Territory.
- The division of powers between the Centre and States.
- Executive: President, Prime Minister, and Council of Ministers.
- Legislature: Parliament (Lok Sabha and Rajya Sabha).

- Judiciary: Supreme Court, High Courts, and Subordinate Courts.

Unit 4: Constitutional Amendments and Provisions (3 Hours)

- Overview of Constitutional Amendments and their significance.
- Procedure for amending the Constitution.
- Landmark amendments (e.g., 42nd, 44th, 73rd, and 74th Amendments).
- Emergency provisions in the Constitution.

Unit 5: Constitutional Bodies and Their Roles (3 Hours)

- Election Commission of India.
- Comptroller and Auditor General (CAG).
- Finance Commission.
- Union Public Service Commission (UPSC).
- State Public Service Commissions (SPSC).

Textbooks:

1. **M. Laxmikanth**, *Indian Polity*, McGraw Hill Education, 6th Edition, 2021.
2. **Granville Austin**, *The Indian Constitution: Cornerstone of a Nation*, Oxford University Press, 1999.

Reference Books:

1. **D.D. Basu**, *Introduction to the Constitution of India*, LexisNexis, 25th Edition, 2021.
2. **Subhash C. Kashyap**, *Our Constitution: An Introduction to India's Constitution and Constitutional Law*, National Book Trust, 2010.
3. **P.M. Bakshi**, *The Constitution of India*, Universal Law Publishing, 15th Edition, 2021.
4. **Durga Das Basu**, *Shorter Constitution of India*, LexisNexis Butterworths Wadhwa Nagpur, 14th Edition, 2018.
5. **V.N. Shukla**, *Constitution of India*, Eastern Book Company, 13th Edition, 2017.

Articulation Matrix for COs and PSOs

COs/PSOs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PSO1 2
CO1	S	M	L	M	L	L	L	L	M	S	L	L
CO2	M	L	L	M	M	L	L	L	M	S	L	L
CO3	M	L	L	M	M	L	L	L	M	S	L	L
CO4	M	L	L	S	L	L	L	L	M	S	L	L
CO5	M	L	L	M	M	L	L	L	M	S	L	L

Blooms Taxonomy Level (BTL) per Unit:

Unit	BTL
Unit 1: Historical Background	Remembering, Understanding
Unit 2: Key Features of the Constitution	Understanding, Analyzing
Unit 3: Structure of Government	Understanding, Applying
Unit 4: Constitutional Amendments and Provisions	Applying, Analyzing
Unit 5: Constitutional Bodies and Their Roles	Evaluating, Creating

Semester		Subject Code	Subject	L	T	P	Total	Credits
IV	VAC	BCHF234T60	Indian Knowledge System- II- Rasasastra	2	0	0	2	2

Course Objectives:

- To understand the historical context, evolution, and fundamental principles of Rasasastra.
- To learn about the classification, properties, and preparation methods of minerals, metals, and herbal ingredients in Rasasastra.
- To gain knowledge of traditional and modern techniques used in the preparation of Rasa medicines, including Bhasma, Kupipakva, and ParpatiRasayana.
- To analyze the chemical composition, pharmacological aspects, and therapeutic applications of Rasa medicines using modern analytical techniques.
- To evaluate contemporary research, innovations, and the ethical and legal aspects of Rasasastra in modern healthcare.

Course Outcomes:

By the end of this course, students will be able to:

- **CO1:** Understand the origin, historical development, and fundamental principles of Rasasastra and its relevance to modern chemistry.
- **CO2:** Demonstrate the ability to classify, purify, and prepare minerals, metals, and herbal ingredients used in Rasasastra formulations.
- **CO3:** Apply traditional and modern preparation techniques for Rasa medicines and understand their quality control and standardization processes.
- **CO4:** Analyze the chemical composition and therapeutic applications of Rasa medicines, integrating modern pharmacological concepts.
- **CO5:** Evaluate modern research trends, standardization practices, and ethical considerations in the study and application of Rasasastra.

Unit 1: Introduction to Rasasastra

Historical Context and Evolution- Overview of Rasasastra: Origin and historical development- The term Rasa and Rasayan- Development of Rasayana sastra through ages. Basic Concepts -and Philosophical Foundations-Fundamental principles of Rasasastra. Philosophical underpinnings and their relevance to modern chemistry. Relation to Ayurveda- Connection between Rasasastra and Ayurveda. Importance of Rasasastra in traditional Indian medicine.

Unit 2: Raw Materials and Preparation

Minerals and Metals in Rasasastra -Classification, properties, and significance of minerals and metals. Purification processes (Shodhana) for metals and minerals. Herbal Ingredients - Role of herbs in Rasasastraformulations.Methods of collection, purification, and storage. Laboratory Setup and Equipment- Traditional and modern equipment used in Rasasastra. Safety protocols in handling raw materials and chemicals.

Unit 3: Preparation Techniques and Methods

Bhasma Preparation - Definition and importance of Bhasma. Detailed preparation process, including Puta system.Quality control and standardization of Bhasma. Kupipakva and ParpatiRasayana- Introduction to KupipakvaRasayana: Methods and applications. Preparation and significance of ParpatiRasayana. Pottali and KhalviRasayana- Techniques and applications of Pottali and KhalviRasayana. Modern adaptations and relevance.

Unit 4: Chemical Analysis and Therapeutic Applications

Chemical Composition and Analysis- Analytical techniques for studying Rasa medicines. Modern chemical analysis of traditional preparations. Pharmacological Aspects- Mechanisms of action of Rasa medicines. Pharmacokinetics and pharmacodynamics in contemporary terms. Therapeutic Applications- Case studies on the therapeutic applications of Rasa medicines. Integration of Rasasastra principles in modern therapeutic practices.

Unit 5: Contemporary Relevance and Research

Modern Research and Innovations- Current trends in Rasasastra research. Innovations and modern methodologies in studying Rasa medicines. Standardization and Quality Control. Modern approaches to standardization of Rasa formulations. Quality control measures and regulatory standards. Ethical and Legal

Aspects- Ethical considerations in the practice and research of Rasashastra. Regulatory framework governing the use of Rasa medicines in modern healthcare.

Text Books:

1. A Textbook of Rasashastra- Ravindra Angadi, ChaukhambaSurbharati Prakashan, 2014
2. Rasa Sastra- Dr. Himasagara Chandra murthy, 2008
3. Text book of rasashastra- Dr. Ankit Kumar Gupta and Dr. Vinay R. Kadibagli, Chaukhamba, 2022.

Reference Books:

1. RasashastraPrayogiki- Srivatsava, Yadav and Prof. Ramesh saxena.
2. A Textbook of Rasashastra- Dr. B.S. Joshi, Chaukhambha Orientalia, 2012.
3. Ayurvedic Mineralogy: A Handbook of Rasashastra" by Dr. S.S. Hiremath, Chaukhambha Orientalia, 2010

CO-PSO Articulation Matrix

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	2	1	1	2	1	1	2	2	2	2	2
CO2	2	3	3	1	2	1	2	2	2	1	2	1
CO3	3	3	3	1	3	1	2	3	2	1	2	1
CO4	2	3	2	2	3	2	3	2	3	2	2	3
CO5	1	2	3	2	3	2	3	3	3	2	2	

Bloom's Taxonomy Levels for Rasashastra Topics

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Introduction to Rasashastra	✓	✓	✓			
Raw Materials and Preparation	✓	✓	✓	✓		
Preparation Techniques and Methods	✓	✓	✓	✓		
Chemical Analysis and Therapeutic Applications	✓	✓	✓	✓	✓	
Contemporary Relevance and Research	✓	✓	✓	✓	✓	

Semester -V

Semester	Subject Code	Subject	L	T	P	Total	Credits
V		Inorganic Chemistry I	5	0	0	5	5

Course Objectives:

1. To understand the fundamental principles of coordination chemistry.
2. To explore advanced topics in coordination chemistry and their applications.
3. To gain knowledge of organometallic compounds, their structures, and reactions.
4. To comprehend the concepts of acids and bases in inorganic chemistry.

Course Outcomes:

By the end of this course, students will be able to:

- CO1:** Describe the basic concepts and principles of coordination chemistry.
- CO2:** Analyze the structure, bonding, and stability of coordination compounds
- CO3:** Understand the synthesis, properties, and reactions of organometallic compounds and their utility in industrial processes
- CO4:** Evaluate the applications and implications of coordination and organometallic chemistry in various fields.
- CO5:** Explain the various concepts of acids and bases and their importance in inorganic chemistry.

Unit I: Coordination Chemistry - I (12 hrs)

Introduction to Coordination Compounds: Definition, terminology, and historical perspective. Ligands: Classification, nomenclature, and examples. Coordination Number and Geometry: Determination and significance in coordination compounds. Isomerism in Coordination Compounds: Structural and stereoisomerism, types, and examples. Stability of complexes- types of stability- factors affecting stability of complexes.

Unit II: Coordination Chemistry - II (12 hrs)

Bonding Theories: Werner's theory - Valence Bond Theory (VBT)-Crystal Field Theory (CFT): Splitting of d-orbitals, crystal field stabilization energy (CFSE), and applications. Spectrochemical Series: Factors affecting the strength of ligands and their position in the series. Jahn-Teller Distortion: Explanation and

examples in coordination compounds. Molecular Orbital Theory (MOT): Applications in octahedral and tetrahedral complexes.

Unit III: Applications of Coordination Chemistry (12 hrs)

Industrial Applications: Role of coordination compounds in catalysis- Wilkinsons catalyst- Ziegler-Nutta catalyst- Analytical Applications: Use of coordination compounds in qualitative and quantitative analysis. Coordination Compounds in Nanotechnology – MOF Synthesis and applications.

Unit IV: Organometallics (12 hrs)

Introduction to Organometallic Chemistry: Definition, historical background, and significance. Types of Organometallic Compounds: Classification based on metal-carbon bonds. Synthesis of Organometallic Compounds: Methods and examples - Factors affecting the stability and reactivity of organometallic compounds – 18 e⁻rule.- Metal alkene complexes- metal-Cp complexes- synthesis – structure and reactions.

Unit V: Concepts of Acids and Bases (12 hrs)

Acid-Base Theories: Arrhenius, Bronsted-Lowry, Lewis, and HSAB concept. Acid-Base Equilibria: pH, pKa, and buffer solutions. Non-aqueous Solvents: Acid-base behavior in different solvents - Role of acids and bases in industrial processes, environmental chemistry, and biochemistry.

Textbooks

1. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, and P.L. Gaus, Wiley, 3rd Edition, 1995.
2. Inorganic Chemistry, J.E. Huheey, E.A. Keiter, R.L. Keiter, Pearson Education, 4th Edition, 1997.
3. Concise Inorganic Chemistry, J.D. Lee, Wiley, 5th Edition, 2008.
4. Organometallic Chemistry, Gary O. Spessard, Gary L. Miessler, Oxford University Press, 2nd Edition, 2010.
5. Principles of Inorganic Chemistry – B.R.Puri, Sharma and Kalia – Vishal Book House – 2007.

Reference Books

1. Advanced Inorganic Chemistry, F.A. Cotton and G. Wilkinson, Wiley, 6th Edition, 1999.
2. Comprehensive Coordination Chemistry II, J.A. McCleverty and T.J. Meyer, Elsevier, 2003.
3. Organometallic Chemistry, R.C. Mehrotra and A. Singh, New Age International, 2nd Edition, 2007.

4. Concepts and Models of Inorganic Chemistry, B. Douglas, D.H. McDaniel, J.J. Alexander, John Wiley & Sons, 3rd Edition, 2006.

5. Bioinorganic Chemistry: A Short Course, Rosette M. Roat-Malone, Wiley-Interscience, 2nd Edition, 2007.

CO-PSO Articulation Matrix

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	2	2	3	2	2	2	2	2	1	2
CO2	3	3	2	2	3	3	2	2	2	2	1	3
CO3	3	3	3	2	3	3	3	2	3	2	1	3
CO4	3	3	2	2	3	3	2	2	2	2	2	3
CO5	3	2	2	2	2	2	2	2	2	2	1	2

3: Strongly aligns, 2: Moderately aligns, 1: Slightly aligns, 0: Does not align

Possible Levels of Testing based on Bloom's Taxonomy

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Coordination Chemistry - I	✓	✓	✓			
Coordination Chemistry - II	✓	✓	✓	✓		
Applications of Coordination Chemistry	✓	✓	✓	✓	✓	
Organometallics	✓	✓	✓	✓	✓	
Concepts of Acids and Bases	✓	✓	✓	✓	✓	

	Subject Code	Subject	L	T	P	Total	Credits
Core		Organic Chemistry I	5	0	0	5	5

Course Objectives:

1. To understand the mechanisms of organic reactions and their applications.
2. To gain knowledge of stereochemistry and its importance in organic chemistry.
3. To comprehend the properties and reactions of heterocyclic compounds.
4. To learn about amino acids and proteins, their structure, and functions.

Course Outcomes:

By the end of this course, students will be able to:

CO1: Explain the mechanisms of various organic reactions.

CO2: Understand and apply the principles of stereochemistry.

CO3: Utilize Newman projections and Sawhorse representations to depict and analyze the conformations of molecules

CO4: Describe the structure, properties, and reactions of heterocyclic compounds.

CO5: Understand the structure and functions of amino acids and proteins.

Unit I: Mechanism of Organic Reactions (12 hrs)

Introduction to reaction mechanisms: Types of organic reactions - addition, substitution, elimination, and rearrangement reactions. Reactive intermediates: Carbocations, carbanions, free radicals, carbenes, and nitrenes generation stability and reactions. Radical ions- types- generations.

Unit II: Stereochemistry I (12 hrs)

2.1 Isomerism: Structural isomerism and stereoisomerism - Geometrical isomerism: Cis-trans and E-Z notations, determination of configuration, and physical and chemical properties of geometrical isomers. Stereochemistry of compounds with multiple stereogeniccenters: Erythro and threo isomers, diastereomers, and stereoselective reactions.

2.2. Optical isomerism: Chirality, enantiomers, diastereomers, and meso compounds - Configuration: R-S notations, Cahn-Ingold-Prelog rules, sequence rules for assigning configuration - Optical activity: Polarimetry, specific rotation, racemic mixtures, and resolution of racemates.

Unit III: Stereochemistry II (12 hrs)

Conformational analysis: Conformations of ethane, butane, cyclohexane, and monosubstituted cyclohexanes. - Newman projections, Sawhorse representations, and chair-boat conformations of cyclohexane. Atropisomerism: Introduction and examples- allenes, spiranes and biphenyls.- Chiral drugs: Importance of stereochemistry in pharmaceuticals.

Unit IV: Heterocyclics I (12 hrs)

4.1 Introduction to heterocyclic compounds: Definition, classification, and importance - Nomenclature of heterocyclic compounds: Hantzsch-Widman system and common names - Structure, synthesis, and reactions of five-membered heterocycles: Furan, thiophene, and pyrrole - six-membered heterocycles: Pyridine.

4.2 Aromaticity of heterocycles: Huckel's rule and its application to heterocyclic compounds - Biological importance of heterocyclic compounds: Examples and applications.

Unit V: Amino Acids and Proteins (12 hrs)

5.1 Amino acids: Structure, classification, and properties.- Acid-base behavior of amino acids: Isoelectric point, zwitterion formation, and titration curves.

5.2 Peptide bond: Formation and properties, dipeptides and polypeptides - Proteins: Classification, structure (primary, secondary, tertiary, and quaternary structures), and functions - Methods of protein purification and analysis: Chromatography, electrophoresis, and mass spectrometry.

Textbooks:

1. Organic Chemistry, Jonathan Clayden, Nick Greeves, Stuart Warren, Oxford University Press, 2012.
2. Organic Chemistry, Paula Yurkanis Bruice, Pearson, 2016.
3. Advanced organic Chemistry, Bahl, Arun Bahl, S.Chand and Co, 2022.
4. Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Jerry March, Wiley, 1992.
5. Stereochemistry of Organic Compounds, Ernest L. Eliel, Samuel H. Wilen, Wiley, 1994.
6. Heterocyclic Chemistry, J. A. Joule, K. Mills, Wiley, 2010.

Reference Books:

1. Principles of Organic Synthesis, R.O.C. Norman, J.M. Coxon, CRC Press, 1993.
2. Stereochemistry, David G. Morris, RSC Publishing, 2002.

- Heterocyclic Chemistry, T.L. Gilchrist, Pearson, 1997.
- Biochemistry, Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer, W.H. Freeman, 2015.
- Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox, W.H. Freeman, 2017.

CO-PSO Articulation Matrix:

Course Outcome (CO)	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	2	1	1	1	2	1	1	1	1	1
CO2	3	3	2	1	1	1	2	1	1	1	1	1
CO3	3	2	2	1	1	1	2	1	1	1	1	1
CO4	3	2	2	1	1	1	2	1	1	1	1	1
CO5	3	3	2	2	2	2	2	1	2	2	2	2

3: Strongly aligns, 2: Moderately aligns, 1: Slightly aligns, 0: Does not align

Possible Levels of Testing based on Bloom's Taxonomy:

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Mechanism of Organic Reactions	✓	✓	✓	✓		
Stereochemistry I	✓	✓	✓	✓		
Stereochemistry II	✓	✓	✓	✓		
Heterocyclics I	✓	✓	✓	✓		
Amino Acids and Proteins	✓	✓	✓	✓		

	Subject Code	Subject	L	T	P	Total	Credits
Core		Physical Chemistry- I	5	0	0	5	5

Course Objectives:

1. To understand advanced concepts in thermodynamics and their applications.
2. To gain knowledge about the properties and behavior of solutions.
3. To learn the principles and applications of the phase rule.
4. To explore surface chemistry and its significance in various fields.

Course Outcomes:

By the end of this course, students will be able to:

- CO1:** Apply the laws of thermodynamics to chemical and physical processes.
- CO2:** Analyze the behaviour of materials at very low temperature.
- CO3:** Evaluate thermodynamic data and make predictions about chemical behavior.
- CO4:** Utilize the phase rule to determine phase equilibria in different systems.
- CO5:** Analyze and interpret the behavior of solutions and their properties.

Unit I: Thermodynamics II (15 hrs)

Second Law of Thermodynamics: Introduction, statements, and significance - Carnot Cycle: Efficiency and work, Carnot theorem - Entropy: Concept, Entropy as a function of V and T, Entropy as a function of P and T, entropy changes in reversible and irreversible processes, and entropy of the universe. Entropy change in ideal gases and mixing of gases. Gibbs free energy: Definition, relationship with work, and spontaneity - Helmholtz Free Energy: Definition and applications. Numerical Problems

Unit II: Thermodynamics III (15 hrs)

Third Law of Thermodynamics: Nernst heat theorem and applications. Statement of third law-concept of Residual entropy. Exception to third law (CO & N₂O)- Gibbs-Helmholtz Equation: Derivation and significance - Maxwell Relations: Derivations and applications - Fugacity and Activity: Definitions and their use in chemical equilibria. Determination of fugacity by graphical method. Determination of activity and

activity coefficient by emf method. Thermodynamics of open systems- Partial molar properties – chemical potential- Variation of chemical potential with temperature and pressure. Gibbs-Duhem equation.

Unit III: Chemical Equilibrium (15 hrs)

Equilibrium Constant and its significance- K_p and K_c relations – derivation of K_p and K_c for various reactions. - Factors affecting chemical equilibrium -Le Chatelier's Principle and its applications-utility- Equilibrium in heterogeneous systems.vant Hoff isochore – vant Hoff isotherm.Clapeyron equation and Clausius – Clapeyron equation-applications.

Unit IV: Phase Rule (15 hrs)

Introduction to Phase Rule: Definitions and significance - Derivation of Phase Rule: Explanation of variables. One-Component Systems: Water and sulfur systems - Two-Component Systems: Eutectic (Lead-Silver), congruent (Mg-Zn), and incongruent melting points(Na-K)- Applications of Phase Rule: Alloy systems and ceramics. Phase diagram of partially miscible liquids – CST- Phenol-water system – three partially miscible liquid systems.

Unit-V Solutions (15 hrs)

Types of Solutions: Ideal and non-ideal solutions - Raoult's Law: Applications and deviations Colligative Properties: Relative lowering of vapor pressure, elevation of boiling point, depression of freezing point, and osmotic pressure - Van't Hoff Factor: Concept and applications - Activity and Activity Coefficients: Definitions and determination.

Textbooks

1. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma, and M.S. Pathania, Vishal Publishing Co., 48th Edition, 2020.
2. Physical Chemistry: A Molecular Approach, Donald A. McQuarrie John D. Simon, -Viva Books 2019
3. Physical Chemistry, P.W. Atkins and J. de Paula, Oxford University Press, 10th Edition, 2014.
4. Thermodynamics: An Engineering Approach, Y.A. Çengel and M.A. Boles, McGraw-Hill, 8th Edition, 2014.
5. Physical Chemistry, G.M. Barrow, McGraw-Hill, 6th Edition, 1996.
6. Physical Chemistry, K.L. Kapoor, Macmillan Publishers India Ltd., 5th Edition, 2011.

7. A Textbook of Physical Chemistry, A.S. Negi and S.C. Anand, New Age International Publishers, 1st Edition, 2007.

Reference Books

1. Physical Chemistry, Ira N. Levine, McGraw-Hill, 6th Edition, 2009.
2. Introduction to Modern Colloid Science, R.J. Hunter, Oxford University Press, 1994.
3. Principles of Surface Chemistry, G. Adamson, John Wiley & Sons, 3rd Edition, 1997.
4. Chemical Thermodynamics, P. W. Atkins, Cambridge University Press, 2000.
5. Phase Equilibria in Chemical Engineering, T. W. De Loos, Elsevier, 2004.

CO-PSO Articulation Matrix:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	2	2	2	1	1	1	1	2	1	1
CO2	3	2	2	2	2	1	1	1	1	2	1	1
CO3	3	3	2	2	2	2	1	1	1	2	2	1
CO4	3	3	2	3	2	2	2	1	1	2	2	2
CO5	3	3	2	3	2	2	2	1	2	2	2	2

Blooms Taxonomy Table for Physical Chemistry I

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Thermodynamics II	✓	✓	✓	✓	✓	
Thermodynamics III	✓	✓	✓			
Chemical Equilibrium	✓	✓	✓			
Phase Rule	✓	✓	✓	✓		
Solutions	✓	✓	✓	✓		

Paper	Subject code	Subject	L	T	P	Total	Credits
Core		Analytical Chemistry I	5	0	0	5	5

Course Objectives

- To understand the basic principles of analytical chemistry and laboratory safety, emphasizing safe practices and proper handling of chemicals.
- To learn the principles and methods of volumetric and gravimetric analysis, focusing on accurate measurement and analysis techniques.
- To gain knowledge of thermo analytical techniques, including their principles, instrumentation, and applications in real-world scenarios.
- To develop skills in evaluating analytical data with accuracy and precision, ensuring reliable and valid results in chemical analyses.

Course Outcomes

- ✓ **CO1:** Apply laboratory hygiene and safety practices effectively, ensuring a safe working environment in the chemistry lab.
- ✓ **CO2:** Perform volumetric and gravimetric analyses with precision, utilizing proper techniques and methodologies.
- ✓ **CO3:** Interpret data from thermoanalytical techniques, understanding the significance of the results obtained.
- ✓ **CO4:** Evaluate and report analytical data accurately, using appropriate statistical methods and data representation techniques.
- ✓ **CO5:** To understand the principles, and applications of various chromatographic techniques

Unit I: Introduction to Analytical Chemistry (12 hrs)

1.1. Laboratory Hygiene and Safety: GLP (Good Laboratory Practices): Principles and implementation in analytical chemistry, ensuring adherence to high standards- Storage and Handling - first Aid Procedures - minimizing harm -Threshold Vapour Concentration: Understanding safe limits to prevent exposure to harmful vapors in the lab -Waste Disposal and Fume Disposal.

1.2: Evaluation of Analytical Data: Measures of Central Tendency: Mean, median, and mode - Accuracy and Precision – Errors - methods to minimize errors- Use of significant figures and appropriate methods for data reporting.

Unit II: Volumetric Analysis (12 hrs)

2.1. Principles of Volumetric Analysis: Basic concepts and terminologies, essential for understanding titrations and their applications. Types of Titrations - Acid-Base Titrations: ss -Redox Titrations-Complexometric Titrations -Precipitation Titrations- Indicators: Selection and use of different indicators for various titrations –

2.2. Standard Solutions: Preparation, standardization, and calculations involving molarity and normality. Applications: Real-world applications in pharmaceuticals, water analysis, and food chemistry, demonstrating the practical relevance of volumetric analysis.

Unit III: Gravimetric Analysis (12 hrs)

3.1.Principles of Gravimetric Analysis: Fundamental concepts, emphasizing the importance of weight measurement in chemical analysis -Theories of Precipitation - Solubility product and conditions of precipitation - guiding the formation of precipitates -Precipitants: Specific and selective precipitants, both organic and inorganic - Different forms and the purity of precipitates - Co-precipitation and post-precipitation -Precipitation from Homogeneous Solution. digestion of precipitates- washing the precipitate – filtering - weighing- errors.

Unit IV: Thermoanalytical Techniques (12 hrs)

Principles and instrumentation of thermogravimetry (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC)and thermomechanical analysis(TMA). Characteristics of Curves: Interpretation and factors affecting TGA and DTA curves, analysis of thermal data. Applications: Examples such as TGA of calcium oxalate monohydrate and DTA of calcium acetate monohydrate, illustrating practical uses. Purity Determination: Using DSC for pharmaceuticals, ensuring the quality and purity of pharmaceutical products.Thermometric Titration: Principles, instrumentation, and applications, including titration of HCl vs. NaOH and complexometric titrations.

Unit V: Chromatography (12 hrs)

Principles of Chromatography: Basic concepts, terminology, and classifications, essential for understanding separation techniques - Principle, methodology, and applications of column, paper, TLC, GC and HPLC. Uses in pharmaceuticals, food science, and environmental analysis, demonstrating the versatility of chromatography.

Textbooks

1. Fundamentals of Analytical Chemistry, Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch - Cengage Learning, 2013.
2. Quantitative Chemical Analysis, Daniel C. Harris, W.H. Freeman and Company, 2015.
3. Analytical Chemistry: Theory and Practice,U.N. Dash, S. Chand & Company Ltd.,2011.
4. Textbook of Analytical Chemistry, J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas, Pearson Education, 2009.
5. Analytical Chemistry, G.R. Chatwal, S.K. Anand, Himalaya Publishing House, 2017

Reference Books

1. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch- Cengage Learning -2017.
2. Vogel's Textbook of Quantitative Chemical Analysis, G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney -Pearson Education- 2009.
3. Instrumental Methods of Chemical Analysis- B.K. Sharma - Goel Publishing House- 2014.
4. Principles of Analytical Chemistry: A Textbook, Sunita Rattan, S.K. Kataria & Sons, : 2012.
5. Basic Concepts of Analytical Chemistry, S.M. Khopkar, New Age International Publishers, 2019.

PSO-CO Articulation Matrix:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	1	1	3	1	1	1	2	1	1	1	1	1
CO2	1	3	3	1	1	1	2	1	1	2	1	1
CO3	1	3	3	1	1	1	2	1	1	2	1	1
CO4	1	2	2	2	1	1	2	1	1	2	1	1

3: Strongly aligns, 2: Moderately aligns, 1: Slightly aligns, 0: Does not align

Possible Levels of Testing based on Bloom's Taxonomy

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Introduction to Analytical Chemistry	✓	✓	✓			
Volumetric Analysis	✓	✓	✓	✓		
Gravimetric Analysis	✓	✓	✓	✓		
Thermoanalytical Techniques	✓	✓	✓	✓		
Chromatography	✓	✓	✓	✓	✓	

Paper	Subject code	Subject	L	T	P	Total	Credits
Elective		Pharmaceutical Chemistry	3		0	3	3

Course Objectives:

1. To understand the fundamental concepts of pharmaceutical chemistry.
2. To learn about ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity).
3. To gain knowledge of Computer-Aided Drug Design (CADD).
4. To explore various types of pharmaceuticals.
5. To understand career opportunities in the pharmaceutical industry.

Course Outcomes:

- CO1:** Understand the basics of pharmaceutical chemistry and its importance in drug development.
- CO2:** Explain the processes involved in ADMET, their significance in pharmacokinetics and pharmacodynamics.
- CO3:** Utilize Computer-Aided Drug Design (CADD) techniques in the development of new drugs.
- CO4:** Identify and classify different types of pharmaceuticals.
- CO5:** Explore career opportunities and the various roles available in the pharmaceutical industry.

Unit I: Introduction to Pharmaceutical Chemistry (9 hrs)

Definition and scope of pharmaceutical chemistry - History and development of pharmaceutical chemistry. Role of pharmaceutical chemistry in drug discovery and development -Basic concepts of drug action: drug-receptor interactions, dose-response relationships- SAR – QSAR – Pharmacopea- Placebo – LD50 – Therapeutic index.

Unit II: ADMET (9 hrs)

Mechanisms and factors affecting drug absorption - Drug distribution mechanisms, volume of distribution, and factors affecting distribution – Drug metabolization- Phase I and Phase II reactions - factors affecting drug metabolism - Routes of drug excretion, factors affecting drug excretion - Types of toxicity, toxicokinetics, and assessment of drug toxicity.

Unit III: Computer-Aided Drug Design (CADD) (9 hrs)

Introduction to CADD and its importance in drug discovery -Molecular modeling techniques: homology modeling, molecular docking, QSAR (Quantitative Structure-Activity Relationship) - Virtual screening and its applications. Case studies of successful drug design using CADD.

Unit IV: Types of Pharmaceuticals (9 hrs)

Classification of drugs based on therapeutic use, chemical structure, and mode of action -Antibiotics, antivirals, antifungals, and antiparasitics -Analgesics, anti-inflammatory drugs, and antipyretics - Cardiovascular drugs, CNS drugs, and gastrointestinal drugs.

Unit V: Careers in the Pharmaceutical Industry (9 hrs)

Overview of the pharmaceutical industry - Various career options: Research and Development (R&D), Quality Control (QC), Quality Assurance (QA), Regulatory Affairs, Clinical Research, Sales and Marketing - Skills required for different roles -Professional development and opportunities for growth in the pharmaceutical industry.

Textbooks:

1. Pharmaceutical Chemistry – Jayashree Ghosh – S.Chand& Co.- 2nd Edition- 2014
2. Pharmaceutical Chemistry by David G. Watson, Elsevier, 3rd Edition, 2012.
3. An Introduction to Medicinal Chemistry by Graham L. Patrick, Oxford University Press, 6th Edition, 2017.
4. Textbook of Medicinal Chemistry by V. Alagarsamy, Elsevier, 1st Edition, 2010.

Reference Books:

1. Foye's Principles of Medicinal Chemistry by Thomas L. Lemke and David A. Williams, Lippincott Williams & Wilkins, 7th Edition, 2012.
2. Burger's Medicinal Chemistry, Drug Discovery and Development by Donald J. Abraham and David P. Rotella, Wiley, 7th Edition, 2010.
3. Medicinal Chemistry by Ashutosh Kar, New Age International, 5th Edition, 2010.

CO-PSO Articulation Matrix:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
--------	------	------	------	------	------	------	------	------	------	-------	-------	-------

CO1	3	2	1	1	2	2	1	1	1	1	1	2
CO2	3	3	2	2	2	2	2	2	1	2	2	2
CO3	3	3	3	3	2	2	2	2	2	2	2	3
CO4	3	2	2	2	2	2	2	2	2	2	2	2
CO5	3	2	1	1	1	1	1	1	1	1	1	2

Blooms Taxonomy Table for Pharmaceutical Chemistry

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Introduction to Pharmaceutical Chemistry	✓	✓	✓			
ADMET	✓	✓	✓	✓		
Computer-Aided Drug Design (CADD)	✓	✓	✓	✓	✓	
Types of Pharmaceuticals	✓	✓	✓	✓		
Careers in the Pharmaceutical Industry	✓	✓	✓	✓	✓	

Paper	Subject code	Subject	L	T	P	Total	Credits
Elective		Green Chemistry	3		0	3	3

Course Objectives:

1. To understand the principles and concepts of green chemistry.
2. To explore sustainable and environmentally friendly chemical processes.
3. To learn about the design and synthesis of green chemicals and materials.
4. To evaluate the environmental impact of chemical processes and products.
5. To study real-world applications and case studies of green chemistry.

Course Outcomes:

- CO1:** Explain the principles and concepts of green chemistry.
- CO2:** Identify and apply sustainable chemical practices in various industries.
- CO3:** Design and synthesize green chemicals and materials.
- CO4:** Evaluate the environmental impact of chemical processes and propose improvements.
- CO5:** Analyze case studies and real-world applications of green chemistry.

Unit I: Introduction to Green Chemistry (9 hrs)

Definition and significance of green chemistry -Twelve principles of green chemistry -Atom economy and E-factor -Green chemistry metrics: Carbon footprint, water footprint, and energy efficiency Historical perspective and development of green chemistry.

Unit II: Green Synthesis and Catalysis (9 hrs)

Green solvents: Supercritical fluids, ionic liquids, and water -Alternative reaction conditions: Microwave, ultrasound, and photochemistry. Catalysis in green chemistry: Homogeneous and heterogeneous catalysis, biocatalysis. Examples of green synthesis: Renewable feedstocks, enzymatic transformations, and solvent-free reactions.

Unit III: Renewable Resources and Biopolymers (9 hrs)

Renewable resources: Biomass, bio-based chemicals, and biofuels -Biopolymers: Synthesis, properties, and applications -Green polymerization techniques: Atom transfer radical polymerization (ATRP), ring-opening polymerization (ROP) -Case studies: PLA, PHA, and other bioplastics.

Unit IV: Green Analytical Techniques (9 hrs)

Green analytical chemistry: Principles and applications -Miniaturization and automation in analytical techniques.Green sample preparation methods: Solid-phase microextraction (SPME), microwave-assisted extraction (MAE).Green chromatographic and spectroscopic methods -Life cycle assessment (LCA) and environmental impact analysis.

Unit V: Industrial Applications and Case Studies (9 hrs)

Green chemistry in pharmaceuticals: Designing safer drugs and reducing waste. Green chemistry in agriculture: Pesticides, fertilizers, and sustainable practices. Green chemistry in materials science: Sustainable materials and energy storage -Case studies: Successful implementation of green chemistry in industry -Future trends and challenges in green chemistry.

Textbooks:

1. "Green Chemistry: Theory and Practice" by Paul T. Anastas and John C. Warner, Oxford University Press, 1st Edition, 2000.
2. "Introduction to Green Chemistry" by Albert S. Matlack, CRC Press, 2nd Edition, 2010.
3. "Green Chemistry: An Introductory Text" by Mike Lancaster, Royal Society of Chemistry, 2nd Edition, 2010.
4. "Green Chemistry: Fundamentals and Applications" by Rashmi Sanghi and M. M. Srivastava, Wiley, 1st Edition, 2018.

Reference Books:

1. "Handbook of Green Chemistry and Technology" by James Clark and Duncan Macquarrie, Wiley, 1st Edition, 2008.
2. "Green Chemistry: Principles and Practice" by David J. C. Constable, Catherine C. McElroy, Mark C. Cann, and Paul T. Anastas, Oxford University Press, 1st Edition, 2013.
3. "Green and Sustainable Medicinal Chemistry: Methods, Tools, and Strategies for the 21st Century Pharmaceutical Industry" by Louise Summerton, Helen F. Sneddon, Lynsey J. Whiteacre, and Jennifer F. B. Hodgson, Royal Society of Chemistry, 1st Edition, 2016.

4. "Environmental Chemistry: A Global Perspective" by Gary W. vanLoon and Stephen J. Duffy, Oxford University Press, 4th Edition, 2017.
5. "Green Chemistry: Environmentally Benign Reactions" by V. K. Ahluwalia, Ane Books India, 1st Edition, 2012.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	2	2	2	2	1	2	2	2	2	3
CO2	3	3	3	3	2	3	2	3	2	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	2	3	3	3

CO-PSO Articulation Matrix

3: Strongly aligns, 2: Moderately aligns, 1: Slightly aligns, 0: Does not align

Blooms Taxonomy Table for Green Chemistry

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Introduction to Green Chemistry	✓	✓	✓	✓		
Green Synthesis and Catalysis	✓	✓	✓	✓		
Renewable Resources and Biopolymers	✓	✓	✓	✓	✓	
Green Analytical Techniques	✓	✓	✓	✓		
Industrial Applications and Case Studies	✓	✓	✓	✓	✓	

Paper	Subject code	Subject	L	T	P	Total	Credits
Elective		Major Lab –VI- Physical Chemistry Lab	2		3	3	2

LIST OF EXPERIMENTS:

1. Critical Solution Temperature of Phenol – water system
2. Effect of impurity on Critical solution Temperature
3. Transition Temperature of a salt hydrate.
4. Rast's Method determination of molecular weight of a non-volatile solute
5. Phase Diagram (Simple eutectic system)
6. Kinetics of Ester Hydrolysis – acid catalyzed hydrolysis of ethyl acetate
7. Kinetics of reaction between $K_2S_2O_8$ and KI – clock reaction method
8. Conductometric Acid-Base Titration
9. Potentiometric Redox Titration
10. Determination of cell constant

Reference Books:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)
2. R.Mukhopadhyay,P.Chatterjee.,Advanced Practical Chemistry,3rd edition,Arunabha Sen Books & Allied Pvt,Ltd. (2007)
3. A Finlay and J.A.Kitchener, Practical Physical Chemistry, Longman (1973)
4. F.Daniels and J.H.Mathews, Experimental Physical Chemistry, Longman (1985)

Scheme of Valuation	
Record	10 marks
Procedure Writing	20 marks
Experiment	30 marks

Calculation and Graph	20 marks
Result	10 marks
Viva	10 marks
Total	100 marks

Semester-VI

Paper	Subject code	Subject	L	T	P	Total	Credits
Core		Inorganic Chemistry-II	5		0	5	5

Course Objectives:

1. To understand the fundamental principles and applications of coordination chemistry.
2. To explore the various types of reactions in metal complexes and their mechanisms.
3. To gain knowledge about metallic bonding, alloy formation, and their properties.
4. To comprehend the basics of nuclear chemistry, including radioactivity and nuclear reactions.
5. To apply concepts of inorganic chemistry to solve practical problems in the field.

Course Outcomes:

By the end of this course, students will be able to:

- CO1:** Explain the principles and applications of coordination chemistry.
- CO2:** Describe and analyze the reactions in metal complexes.
- CO3:** Understand metallic bonding and the properties of alloys.
- CO4:** Grasp fundamental concepts in nuclear chemistry, including radioactivity and nuclear reactions.
- CO5:** Apply knowledge of inorganic chemistry to various scientific and industrial problems.

Unit I: Reactions in Metal Complexes-I (12 hours)

Substitution Reactions: Mechanisms of ligand substitution reactions in octahedral and square planar complexes. Kinetics and Mechanism: Rate laws, transition state theory, and intermediate formation - Factors Affecting Substitution Reactions: Nature of central metal ion, charge, and the nature of ligands - Electron Transfer Reactions: Inner sphere and outer sphere mechanisms, Marcus theory.

Unit II: Reactions in Metal Complexes-II (12 hours)

Redox Reactions: Mechanisms and applications in catalysis -Photochemical Reactions: Principles, types, and applications -Stability of Metal Complexes: Thermodynamic and kinetic stability, Irving-Williams series. Catalysis by Metal Complexes: Homogeneous and heterogeneous catalysis, examples, and industrial applications.

Unit III: Metallic Bonding & Alloys (12 hours)

Metallic Bonding: Theories of metallic bonding, band theory, and Fermi level -Properties of Metals: Electrical, thermal, and mechanical properties - Alloys: Types, preparation methods, and applications- Hume -Rothery rules. Some special alloys – Monel metal – Solder – 916 Gold – Brass- Bronze- Bell metal- Stainless steel- Special steels. Intermetallic Compounds: Structure and properties.

Unit IV: Nuclear Chemistry-I (12 hours)

Introduction to Nuclear Chemistry: Radioactivity, types of radioactive decay -Nuclear Reactions: Types, equations, and energy changes -Nuclear Structure: Nucleons, binding energy, nuclear stability -Detection and Measurement of Radioactivity: Geiger-Müller counter, scintillation counters, and applications.

Unit V: Nuclear Chemistry-II (12 hours)

Nuclear Fission and Fusion: Processes, energy release, and applications -Nuclear Reactors: Types, components, and functioning -Applications of Radioisotopes: Medicine, industry, and agriculture -Radiation Safety: Principles, protection methods, and regulations.

Textbooks:

1. Principles of inorganic chemistry, B.R.Puri, L.R.Sharma, K.C.Khlaia, Vishal Publishing Co, 2022.
2. "Inorganic Chemistry" by J.D. Lee, Oxford University Press, 2013.
3. Selected Topics in Inorganic Chemistry, Madan, R. D., W. U. Malik, and G. D. Tuli, S. Chand & Company Ltd, 2010.
4. "Advanced Inorganic Chemistry" by F. Albert Cotton and Geoffrey Wilkinson, John Wiley & Sons, 1999.
5. "Basic Inorganic Chemistry" by F.A. Cotton, G. Wilkinson, and P.L. Gaus, Wiley India, 2007.

Reference Books:

1. "Inorganic Chemistry: Principles of Structure and Reactivity" by James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Pearson Education, 2006.
2. "Inorganic Chemistry" by Gary L. Miessler and Donald A. Tarr, Pearson Education, 2010.
3. "Nuclear Chemistry" by Gregory Choppin, Jan-Olov Liljenzin, Jan Rydberg, and Christian Ekberg, Elsevier, 2013.

CO-PSO Articulation Matrix:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
--	------	------	------	------	------	------	------	------	------	-------	-------	-------

CO1	3	3	3	3	3	3	2	3	3	3	3	2
CO2	3	3	3	3	3	3	2	3	3	3	3	2
CO3	3	3	3	3	3	3	2	3	3	3	3	2
CO4	3	3	3	3	3	3	2	3	3	3	3	2
CO5	3	3	3	3	3	3	2	3	3	3	3	2

Possible Levels of Testing Based on Bloom's Taxonomy:

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Reactions in Metal Complexes-I	✓	✓	✓	✓		
Reactions in Metal Complexes-II	✓	✓	✓	✓	✓	
Metallic Bonding & Alloys	✓	✓	✓	✓		
Nuclear Chemistry-I	✓	✓	✓	✓		
Nuclear Chemistry-II	✓	✓	✓	✓		

Paper	Subject code	Subject	L	T	P	Total	Credits
Elective		Organic Chemistry-II	5		0	5	5

Course Objectives:

1. To gain an in-depth understanding of carbonyl compounds and their reactions.
2. To understand various molecular rearrangements and their significance in organic synthesis.
3. To learn about the structure, properties, and reactions of carbohydrates.
4. To study the structure, properties, and significance of selected alkaloids and terpenoids.
5. To explore the principles and processes in industrial organic chemistry, including the production of dyes, distilleries, and sugar industries.

Course Outcomes:

- CO1:** Explain the structure, properties, and reactions of carbonyl and dicarbonyl compounds.
- CO2:** Understand and predict the outcomes of various molecular rearrangements.
- CO3:** Analyze the structure, properties, and reactions of carbohydrates.
- CO4:** Identify and describe the structure and significance of selected alkaloids and terpenoids.
- CO5:** Apply knowledge of organic chemistry in industrial processes, including the synthesis and applications of dyes, distilleries, and sugar industry products.

Unit I: Carbonyl and Dicarbonyl Compounds (12 hours)

Aldehydes and Ketones: Structure, nomenclature, and properties. Mechanisms of nucleophilic addition reactions - Role of aldehydes and ketones as starting materials in organic synthesis - Aldol Condensation-dehydration to α,β -unsaturated carbonyl compounds -Claisen Condensation- Schmidt condensation - Curcumin -Cannizzaro Reaction. Dicarbonyl Compounds: Structure, properties, and reactivity. types of dicarbonyls 1,2 1,3 1,4 dicarbonyls. Applications in organic synthesis

Unit II: Molecular Rearrangements (12 hours)

Types of Rearrangements: Nucleophilic and electrophilic rearrangements. Mechanisms and examples of Wagner-Meerwein, Pinacol-Pinacolone, Beckmann, Hofmann, Curtius, and Baeyer-Villiger, Fries rearrangements -Synthetic applications of rearrangements.

Unit III: Carbohydrates (12 hours)

Monosaccharides: Structure, configuration, and conformation. Reactions of monosaccharides: oxidation, reduction, osazone formation, and glycoside formation. Disaccharides and Polysaccharides: Structure and properties of sucrose, lactose, maltose, starch, cellulose, and glycogen. Glycosidic linkages and their significance.

Unit IV: Alkaloids and Terpenoids (12 hours)

Alkaloids: Structure, classification, extraction, and biological importance. Detailed study of conine, nicotine, papaverine, and piperine.

Terpenoids: Classification, isoprene rule, and biosynthesis. Structure and significance of geraniol, nerol, and limonene.

Unit V: Industrial Organic Chemistry (12 hours)

Dyes: Types of dyes, synthesis, and applications of azo dyes (e.g., Methyl Orange, Congo Red), anthraquinone dyes (e.g., Alizarin), and phthalocyanine dyes. - Distilleries: Production and chemistry of alcohols, principles of fermentation, and industrial processes -Sugar: Extraction, refining, and chemical properties of sugars. Industrial applications of sugar chemistry.

Textbooks:

1. Organic Chemistry by Jonathan Clayden, Nick Greeves, and Stuart Warren, Oxford University Press, 2012.
2. Organic Chemistry by Paula Yurkanis Bruice, Pearson Education, 2016.
3. A Textbook of Organic Chemistry by Arun Bahl and B.S. Bahl, S. Chand Publishing, 2020.
4. Advanced Organic Chemistry by Jerry March, Wiley, 2007.
5. Industrial Chemistry, Sharma, B. K. Krishna Prakashan, 2023.

Reference Books:

1. Organic Chemistry by Robert T. Morrison and Robert N. Boyd, Pearson, 2010.
2. Organic Chemistry by L.G. Wade Jr., Pearson, 2013.
3. Reaction Mechanism in Organic Chemistry by Mukherjee and Singh, Macmillan, 2009.
4. Industrial Organic Chemistry by Klaus Weissermel and Hans-Jürgen Arpe, Wiley-VCH, 2008.

CO-PSO Articulation Matrix:

	<i>PSO 1</i>	<i>PSO 2</i>	<i>PSO 3</i>	<i>PSO 4</i>	<i>PSO 5</i>	<i>PSO 6</i>	<i>PSO 7</i>	<i>PSO 8</i>	<i>PSO 9</i>	<i>PSO 10</i>	<i>PSO 11</i>	<i>PSO 12</i>
CO1	3	2	2	1	1	1	2	3	3	3	1	2
CO2	3	3	2	2	3	3	1	3	2	3	2	2
CO3	3	2	3	2	3	3	1	3	2	2	2	3
CO4	3	3	3	2	3	2	2	3	2	3	3	2
CO5	3	3	2	3	2	1	2	3	2	2	3	3

Bloom's Taxonomy Table:

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Carbonyl and Dicarbonyl Compounds	✓	✓	✓	✓		
Molecular Rearrangements	✓	✓	✓	✓	✓	
Carbohydrates	✓	✓	✓	✓		
Alkaloids and Terpenoids	✓	✓	✓	✓		
Industrial Organic Chemistry	✓	✓	✓	✓	✓	

Paper	Subject code	Subject	L	T	P	Total	Credits
Elective		Physical Chemistry-II	5		0	5	5

Course Objectives:

1. To understand the principles of electrical conductance in metals and electrolytic solutions.
2. To explore the theory and applications of electrochemical cells.
3. To study the phenomenon of corrosion and methods to control it.
4. To learn about energy conversion devices and their principles.

Course Outcomes:

By the end of this course, students will be able to:

CO1: Explain the electrical conductivity in metals and electrolytic solutions and its measurement methods.

CO2: Analyze electrochemical cells and calculate cell electromotive force (EMF) and electrode potentials.

CO3: Understand the types of corrosion and apply methods to control corrosion in different environments.

CO4: Describe the principles and types of fuel cells and batteries, and discuss their role in energy conversion.

CO5: Explain the role of electrochemistry in energy conversion and storage, and analyze solar energy conversion devices such as photovoltaic cells.

Unit I: Electrical Conductance in Metals and Electrolytic Solutions (15 hours)

Electrical conductivity in metals and electrolytic solutions -Specific conductance and equivalent conductance. Measurement of conductance Kohlrausch's bridge method -Arrhenius theory of electrolytic dissociation and its limitations -Ostwald's dilution law, applications, and limitations -Variation of equivalent conductance with concentration, ionic mobility -Kohlrausch's law, applications -Elementary treatment of the Debye-Huckel-Onsager equation for strong electrolytes -Evidence for ionic atmosphere, Wien effect, Debye-Falkenhagen effect. Conductance measurement applications: Determination of K_a of acids, solubility product of sparingly soluble salts, conductometric titrations. Numerical problems

Unit II: Electrochemical Cells – I (15 hours)

Types of reversible electrodes: gas/metal ion, metal/metal ion, metal/insoluble salt/anion -Electrode reactions, Nernst equation, derivation of cell E.M.F and single electrode potential -Standard hydrogen electrode, reference electrodes, standard electrode potentials, sign convention, electrochemical series - Determination of pH using hydrogen and quinhydrone electrodes.

Unit III: Electrochemical Cells – II (15 hours)

Electrolytic and galvanic cells: reversible and irreversible cells, conventional representation -Electromotive force of a cell, measurement, computation of thermodynamic quantities of cell reactions (ΔG , ΔH , ΔS , and K), Gibbs Helmholtz equation -Concentration cell, Nernst equation, concentration cell with and without transport, liquid junction potential -Applications: EMF of concentration cells, valency of ion determination, solubility product, activity coefficient, potentiometric titrations.

Unit IV: Corrosion and its control (15 hours)

Definition of corrosion-Types of corrosion: uniform, galvanic, crevice, pitting, and stress corrosion cracking - Factors affecting corrosion-- Electrochemical theory of corrosion - Anodic and cathodic reactions - Corrosion cells and their components - Corrosion potential and corrosion current - Techniques for measuring corrosion rates: weight loss, electrical resistance, polarization resistance, and electrochemical impedance spectroscopy -Selection of corrosion-resistant materials- Surface treatments: painting, coating, and plating- Cathodic protection: sacrificial anode and impressed current systemsInhibitors: types and applications- Design considerations for corrosion control-Maintenance practices to prevent corrosion

Unit V: Energy Conversion Devices (15 hours)

Principles and types of fuel cells -Principles and types of batteries -Role of electrochemistry in energy conversion and storage- Solar cells – PV cells- DSSC primitive treatment only- Problems associated with solar energy conversions.

Textbooks:

1. Principles of Physical Chemistry, Puri and Sharma, Vishal Publications- 48th edition- 2020.
2. Electrochemistry by Philip H. Rieger
3. Electrochemical Methods: Fundamentals and Applications by Allen J. Bard and Larry R. Faulkner
4. Fuel Cells – principles and Applications- B.Viswanathan& M AuliceScibioh, Universities press -2006

Reference Books:

1. Electrochemical Methods by A.J. Bard and L.R. Faulkner
2. Modern Electrochemistry by John O'M. Bockris and Amulya K.N. Reddy
3. Electrochemical Engineering by Thomas F. Fuller, John N. Harb, and Alan J. Bard

CO-PSO Articulation Matrix:

	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	1	1	1	1	1	1	1	1	1	1
CO2	3	3	2	2	2	2	1	1	1	1	1	1
CO3	3	2	2	2	2	1	1	1	1	1	1	1
CO4	3	3	3	2	2	2	2	1	1	1	1	1
CO5	3	3	3	2	2	2	2	1	1	1	1	2

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Electrical Conductance in Metals and Solutions	✓	✓	✓	✓		
Electrochemical Cells – I	✓	✓	✓	✓		
Electrochemical Cells – II	✓	✓	✓	✓		
Corrosion and its Control	✓	✓	✓			
Energy Conversion Devices	✓	✓	✓	✓		

Paper	Subject code	Subject	L	T	P	Total	Credits
Core		Analytical Chemistry II	4	1	0	5	5

Course Objectives

- To understand advanced techniques in spectrochemical analysis, emphasizing their principles and applications.
- To gain in-depth knowledge of various spectroscopic methods, including their theoretical and practical aspects.
- To develop the ability to apply these techniques in real-world analytical problems, enhancing problem-solving skills.
- To interpret and analyze data from these techniques effectively, ensuring accurate and reliable results.

Course Outcomes:

CO1 Conduct spectrochemical analyses proficiently, utilizing advanced techniques and methodologies.

CO2 Understand and apply the principles of different spectroscopic techniques, enhancing analytical capabilities.

CO3 Analyze and interpret data from spectroscopic methods, ensuring accurate and meaningful results.

CO4 Utilize advanced analytical techniques for problem-solving in various fields, demonstrating practical applications.

Unit I: Principles of Spectroscopy (12 hrs)

Electromagnetic Radiation: Nature, properties, and interaction with matter, fundamental to understanding spectroscopy. Absorption and Emission: Basic principles and mechanisms, essential for various spectroscopic techniques. Spectroscopic Techniques: Overview of various techniques and their applications. Applications of Spectroscopy: Identifying chemical compounds, studying molecular structures, and quantitative analysis, demonstrating the practical relevance.

Unit II: Rotational and Vibrational Spectroscopy (12 hrs)

2.1. Rotational Spectroscopy: Principles – Rigid rotor and Non-rigid rotors -selection rules, and molecular rotation, essential for studying molecular structure. Instrumentation-Applications: Determining bond lengths and molecular structure.

2.2. Vibrational Spectroscopy (IR and Raman): Principles, molecular vibrations, and selection rules - Instrumentation: Infrared and Raman spectrometers- Applications: Identifying functional groups, studying molecular dynamics, and other practical uses of vibrational spectroscopy.

Unit III: Electronic Spectroscopy and Colorimetry (12 hrs)

3.1. Electronic Spectroscopy: Principles, Jablonski diagram, electronic transitions, fundamental concepts in electronic spectroscopy. Instrumentation: Components and working of spectrometers for electronic spectroscopy. Applications: Analysis of electronic transitions in molecules, studying electronic structures

3.2. Colorimetry: Principles of color absorption and Beer-Lambert law, fundamental concepts in colorimetry. Instrumentation: Determining the concentration of colored compounds, water quality testing, and food analysis, demonstrating practical uses.

Unit IV: NMR and ESR Spectroscopy (12 hrs)

4.1. Nuclear Magnetic Resonance (NMR) Spectroscopy: Principles, chemical shift, spin-spin coupling, fundamental concepts in NMR. NMR spectrometers and components - Applications: Structure determination - demonstrating the practical relevance of NMR for simple molecules.

4.2. Electron Spin Resonance (ESR) Spectroscopy: Principles, g-factor, hyperfine splitting, essential concepts in ESR - Instrumentation: ESR spectrometers - Study of paramagnetic species, radical identification, and reaction mechanisms, providing practical examples of ESR.

Unit V: Spectroanalytical Techniques (12 hrs)

Flame Photometry: Principles, instrumentation, and applications, essential for analyzing metal ions. Atomic Emission Spectroscopy (AES): Principles, instrumentation, and applications, providing insights into elemental analysis. Atomic Absorption Spectroscopy (AAS): Principles, instrumentation, and applications, widely used for trace metal analysis. Inductively Coupled Plasma Emission Spectroscopy (ICPES): Principles, instrumentation, and applications, offering high sensitivity for elemental analysis. Data Analysis: Interpretation of results and troubleshooting common issues.

Textbooks:

1. Spectroscopy - Authors: Pavia, Lampman, Kriz, Vyvyan - Cengage Learning - 2018
2. Introduction to Spectroscopy - Donald L. Pavia, Gary M. Lampman, George S. Kriz, James A. Vyvyan - Brooks Cole - 2015
3. Spectrometric Identification of Organic Compounds - Robert M. Silverstein, Francis X. Webster, David J. Kiemle - Wiley - 2005
4. Spectroscopy in Inorganic Chemistry - Authors: B. K. Sharma - Alpha Science International Ltd - 2004
5. Modern Spectroscopy - J. Michael Hollas - Wiley - 2003

Reference Books

1. Title: Spectroscopy - Authors: William Kemp - Publisher: Palgrave Macmillan - Year: 2015
2. Title: Introduction to Molecular Spectroscopy - Authors: Gordon M. Barrow - Publisher: McGraw-Hill - Year: 1994

3. Title: Spectroscopy and its Applications - Authors: J. C. Sharma - Publisher: Alpha Science International Ltd - Year: 2010
4. Title: Spectroscopic Methods in Organic Chemistry - Authors: Dudley H. Williams - Publisher: Tata McGraw-Hill Education - Year: 2005
5. Title: Spectroscopy for the Biological Sciences - Authors: Gordon G. Hammes - Publisher: Wiley - Year: 2005

CO-PSO Articulation Matrix:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	1	1	3	1	1	1	2	1	1	1	1	1
CO2	1	3	3	1	1	1	2	1	1	2	1	1
CO3	1	3	3	1	1	1	2	1	1	2	1	1
CO4	1	2	2	2	1	1	2	1	1	2	1	1

3: Strongly aligns, 2: Moderately aligns, 1: Slightly aligns, 0: Does not align

Possible Levels of Testing based on Bloom's Taxonomy

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Principles of Spectroscopy	✓	✓	✓		✓	
Rotational and Vibrational Spectroscopy	✓	✓	✓	✓	✓	
NMR and ESR Spectroscopy	✓	✓	✓	✓	✓	
Electronic Spectroscopy and Colorimetry	✓	✓	✓	✓	✓	
Spectroanalytical Techniques	✓	✓	✓	✓		

Paper	Subject code	Subject	L	T	P	Total	Credits
Elective		Polymer Chemistry	3		0	3	3

Course Objectives:

1. To understand the fundamental concepts of polymer chemistry.
2. To learn about the synthesis and characterization of polymers.
3. To explore the properties and applications of various types of polymers.
4. To understand the environmental impact and recycling of polymers.
5. To study advanced topics in polymer chemistry, including light-emitting polymers and flexitronics.

Course Outcomes:

- CO1:** Understand the basic concepts and classifications of polymers.
- CO2:** Explain the methods of polymer synthesis and characterization techniques.
- CO3:** Analyze the properties of polymers and their applications in various industries.
- CO4:** Evaluate the environmental impact of polymers and methods for recycling and disposal.
- CO5:** Discuss advanced topics and recent developments in polymer chemistry, including light-emitting polymers and flexitronics.

Unit I: Introduction to Polymers (9 hrs)

Definition and classification of polymers - Types of polymerization: Addition (chain-growth) and condensation (step-growth) polymerization -Structure and properties of polymers: Molecular weight, crystallinity, glass transition temperature, melting temperature.- Copolymers: Types and properties.

Unit II: Polymer Synthesis (9 hrs)

Methods of polymerization: Bulk, solution, suspension, and emulsion polymerization -Polymerization techniques: Free radical, ionic, coordination, and ring-opening polymerizations -Kinetics and mechanisms of polymerization reactions -Polymerization reactors and process control.

Unit III: Polymer Characterization (9 hrs)

Molecular weight determination: End-group analysis, osmometry, viscometry, light scattering, and gel permeation chromatography (GPC) -Spectroscopic methods: IR, NMR, and UV-Vis spectroscopy -Thermal

analysis: Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA) -Mechanical properties: Tensile strength, elongation, impact resistance, hardness

Unit IV: Properties and Applications of Polymers (9 hrs)

Physical and chemical properties of polymers -Types of polymers: Thermoplastics, thermosetting polymers, elastomers, and fibers -Applications of polymers in various industries: Packaging, automotive, electronics, medical, and construction -Specialty polymers: Conducting polymers, biodegradable polymers, and smart polymers -Advanced applications: Light-emitting polymers and flexitronics.

Unit V: Environmental Impact and Recycling of Polymers (9 hrs):

Environmental issues related to polymer production and disposal -Recycling of polymers: Mechanical, chemical, and energy recovery methods -Biodegradable and sustainable polymers -Regulations and policies for polymer waste management.

Textbooks:

1. "Polymer Science" by V. R. Gowariker, N. V. Viswanathan, and Jayadev Sreedhar, New Age International Publishers, 2nd Edition, 2015.
2. "Textbook of Polymer Science" by Fred W. Billmeyer Jr., Wiley, 3rd Edition, 1984.
3. "Introduction to Polymer Chemistry" by Charles E. Carraher Jr., CRC Press, 4th Edition, 2017.
4. "Polymer Science and Technology" by Joel R. Fried, Prentice Hall, 3rd Edition, 2014.
5. "Polymer Chemistry" by Malcolm P. Stevens, Oxford University Press, 3rd Edition, 1998.

Reference Books:

1. "Principles of Polymerization" by George Odian, Wiley, 4th Edition, 2004.
2. "Contemporary Polymer Chemistry" by Harry R. Allcock, Frederick W. Lampe, and James E. Mark, Prentice Hall, 3rd Edition, 2003.
3. "Handbook of Polymer Synthesis, Characterization, and Processing" by Enrique Saldivar-Guerra and Eduardo Vivaldo-Lima, Wiley, 1st Edition, 2013.
4. "Fundamentals of Polymer Engineering" by Arie Ram, Springer, 2nd Edition, 1997.

CO-PSO Articulation Matrix:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	1	1	2	2	1	1	1	1	1	2
CO2	3	3	2	2	2	2	2	2	1	2	2	2
CO3	3	3	3	3	2	2	2	2	2	2	2	3
CO4	3	2	2	2	2	2	2	2	2	2	2	2
CO5	3	2	1	1	1	1	1	1	1	1	1	2

3 – Strong Alignment, 2-Medium Alignment, 1- Weak Alignment

Bloom's Taxonomy Table for Polymer Chemistry

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Introduction to Polymers	✓	✓	✓	✓		
Polymer Synthesis	✓	✓	✓	✓		
Polymer Characterization	✓	✓	✓	✓	✓	

Properties and Applications of Polymers	✓	✓	✓	✓		
Environmental Impact and Recycling of Polymers	✓	✓	✓	✓	✓	

Paper	Subject code	Subject	L	T	P	Total	Credits
Elective		Environmental Chemistry	3		0	3	3

Course Objectives:

- To understand the chemical processes and phenomena that occur in the environment.
- To study the sources, reactions, transport, and effects of chemical species in the air, water, and soil.
- To learn about the impact of human activities on the environment and the chemical basis of environmental pollution.
- To explore analytical methods for monitoring and controlling environmental pollutants.
- To evaluate the principles and practices of green chemistry and sustainable development.

Course Outcomes:

- CO1:** Explain the fundamental concepts of environmental chemistry and its importance.
- CO2:** Identify and analyze sources and types of environmental pollutants.
- CO3:** Evaluate the chemical processes involved in the degradation and remediation of pollutants.
- CO4:** Apply analytical techniques for monitoring environmental contaminants.
- CO5:** Assess the impact of human activities on the environment and propose sustainable solutions.

Unit I: Introduction to Environmental Chemistry (9 hrs)

Definition and scope of environmental chemistry -Chemical composition of the atmosphere, hydrosphere, lithosphere, and biosphere -Biogeochemical cycles: Carbon, nitrogen, sulfur, and phosphorus cycles. Environmental segments: Air, water, and soil -Environmental pollutants: Types, sources, and effects.

Unit II: Atmospheric Chemistry (9 hrs)

Chemical composition and structure of the atmosphere -Photochemical reactions in the atmosphere: Ozone formation and depletion, smog formation -Greenhouse gases and global warming: Sources, effects, and mitigation -Acid rain: Formation, effects, and control measures -Air pollution: Major air pollutants, sources, effects, and control strategies.

Unit III: Aquatic Chemistry (9 hrs)

Chemical composition of natural waters: Freshwater and seawater -Water pollution: Sources and types of water pollutants (organic, inorganic, biological, radioactive) -Eutrophication: Causes, effects, and control

measures - Heavy metal pollution: Sources, effects, and remediation techniques -Water quality parameters and standards.

Unit IV: Soil Chemistry and Pollution (9 hrs)

Chemical composition of soils and soil formation -Soil pollution: Sources and types of soil pollutants (pesticides, fertilizers, heavy metals) -Soil degradation and desertification -Soil remediation techniques: Phytoremediation, bioremediation, and soil washing -Impact of agriculture and industrial activities on soil quality.

Unit V: Environmental Analysis and Sustainable Practices (9 hrs)

Analytical techniques for environmental monitoring: Sampling, sample preparation, and analysis - Instrumental methods: Spectroscopy, chromatography, electrochemical methods -Green chemistry principles and sustainable practices -Environmental management systems and policies -Case studies on environmental issues and sustainable solutions.

Textbooks:

1. "Environmental Chemistry" by Stanley E. Manahan, CRC Press, 10th Edition, 2017.
2. "Environmental Chemistry: A Global Perspective" by Gary W. vanLoon and Stephen J. Duffy, Oxford University Press, 4th Edition, 2017.
3. "Textbook of Environmental Chemistry" by Balaram Pani, I.K. International Publishing House Pvt. Ltd, 2nd Edition, 2017.
4. "Environmental Chemistry" by A.K. De, New Age International Publishers, 7th Edition, 2012.

Reference Books:

1. "Principles of Environmental Chemistry" by James E. Girard, Jones & Bartlett Learning, 3rd Edition, 2013.
2. "Environmental Chemistry" by Colin Baird and Michael Cann, W.H. Freeman, 5th Edition, 2012.
3. "Green Chemistry: Theory and Practice" by Paul T. Anastas and John C. Warner, Oxford University Press, 1st Edition, 2000.
4. "Environmental Pollution and Control" by J. Jeffrey Peirce, Ruth F. Weiner, and E. Aarne Vesilind, Butterworth-Heinemann, 4th Edition, 1997.

CO-PSO Articulation Matrix:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	2	2	2	2	1	2	2	2	2	3
CO2	3	3	3	3	2	3	2	3	2	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	2	3	3	3

Bloom's Taxonomy Table for Environmental Chemistry

Unit	Remember (B1)	Understand (B2)	Apply (B3)	Analyze (B4)	Evaluate (B5)	Create (B6)
Introduction to Environmental Chemistry	✓	✓	✓			
Atmospheric Chemistry	✓	✓	✓	✓		
Aquatic Chemistry	✓	✓	✓	✓		
Soil Chemistry and Pollution	✓	✓	✓	✓		
Environmental Analysis and Sustainable Practices	✓	✓	✓	✓	✓	