

B.Sc. Chemistry

Syllabus

AFFILIATED COLLEGES

Program Code: 22D

2025 – 2026 Onwards

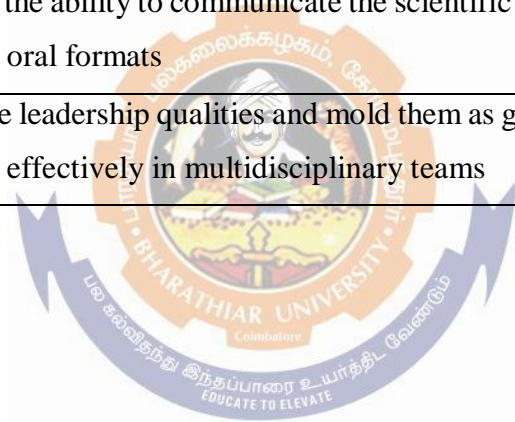


BHARATHIAR UNIVERSITY

(A State University, accredited with “A++” Grade by NAAC,
Ranked 21st among Indian Universities by MHRD-NIRF)

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)	
The B. Sc. Chemistry program describes accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	To produce efficient chemistry graduates with strong fundamentals in various fields of chemistry
PEO2	To make students capable to assess and relate issues to environmental and practice it with integrity and ethics
PEO3	To provide an in-depth knowledge in chemistry and enable them with tools needed for industrial applications
PEO4	To integrate the inter-disciplinary knowledge of physics, mathematics or biological sciences to wide variety of fields
PEO5	To develop the ability to communicate the scientific information in written and oral formats
PEO6	To inculcate leadership qualities and mold them as good team players to function effectively in multidisciplinary teams



Program Specific Outcomes (PSOs)	
After the successful completion of B. Sc. Chemistry program, the students are expected to	
PSO1	Apply chemistry knowledge to solve the problems in various areas.
PSO2	Acquire a skill for safe handling of chemicals, apparatus and instruments
PSO3	Identify and analyze problems and gain skills to interpret chemical information
PSO4	Gain practical knowledge and analytical skills in designing and carrying out chemical experiments
PSO5	Have enough chemistry knowledge to go for higher studies and become entrepreneur



Program Outcomes (POs)	
On successful completion of the B. Sc. Chemistry program	
PO1	Understand the chemistry and apply their knowledge in day-to-day life
PO2	Explore the knowledge of analytical techniques to the industries for various analysis
PO3	Develop skills to carryout experiments in various fields of chemistry
PO4	Identify, formulate and solve the technological problems of the industry
PO5	Apply their theoretical knowledge to make the common people to understand the chemistry behind every chemical changes.
PO6	Confidence with skills and techniques necessary to succeed in the competitive examinations
PO7	Have the knowledge of science principles to practical situations in their respective professional career.

BHARATHIAR UNIVERSITY COIMBATORE 641 046
B. Sc. Chemistry–Revised Scheme of Examinations (CBCS Pattern)
(For the students admitted during the academic year 2025– 26 onwards)

Part	Title of the Course	Hours/ Week	Examination				Credits
			Duration in Hours	Maximum Marks			
				CIA	CEE	Total	
	Semester I						
I	Language- I	6	3	25	75	100	4
II	English-I	6	3	25	75	100	4
III	Core Paper I–General Chemistry-I	7	3	25	75	100	4
III	Core Practical I (Inorganic Qualitative Analysis)	3	-	-	-	-	-
III	Allied A: Paper I [#] (or)	6	3	25	75	100	4
	Allied A: Paper I [@]	4	3	20	55	75	3
III	Allied A: Practical [@]	2	-	-	-	-	-
IV	Environmental Studies*	2	3	-	50	50	2
	Total	30		95	330	425	17
	Semester II						
I	Language– II	6	3	25	75	100	4
II	English–II	2	3	25	25	50*	2
	Naan Mudhalvan Skill Course- Language Proficiency for Employability http://kb.naanmudhalvan.in/Special:Filepath/Cambridge_Course_Details.pdf		-	25	25	50**	2
III	Core Paper II–General Chemistry-II	7	3	25	75	100	4
III	Core Practical I (Inorganic Qualitative Analysis)	4	3	25	75	100	4
III	Allied A: Paper II [#] (or)	6	3	25	75	100	4
	Allied A: Paper II [@]	4	3	20	55	75	3
III	Allied A: Practical [@]	3	3	20	30	50	2
IV	Value Education –Human Rights*	2	3	-	50	50	2
	Total	30		165	410	575	23
	Semester III						
I	Language–III	6	3	25	75	100	4
II	English–III	6	3	25	75	100	4
III	Core Paper III– Inorganic Chemistry-I	3	3	25	75	100	4
III	Core Paper IV–Physical Chemistry-I	3	3	25	75	100	4
III	Allied B: Paper I [#] (or)	6	3	25	75	100	4
	Allied B: Paper I [@]	3	3	20	55	75	3
III	Core Practical II (Volumetric and Organic Analysis)	3	-	-	-	-	-
III	Allied B: Practical [@]	2	-	-	-	-	-
IV	Skill based Subject I: Chemistry of Natural and Synthetic Fibers	1	3	20	55	75	3
IV	Tamil** / Advanced Tamil*(OR) Non-major elective -I (Yoga for Human Excellence) */Women’s Rights*	1	3	-	50	50	2
*	Health and Curriculum	2	-	25	-	25	1
	Total	30		165	460	625	25

Semester IV							
I	Language-IV	6	3	25	75	100	4
II	English-IV	6	3	25	75	100	4
III	Core Paper V–Organic Chemistry-I	4	3	25	75	100	4
III	Core Practical II (Volumetric and Organic Analysis)	3	6	30	45	75	3
III	Allied B: Paper II [#]	6	3	25	75	100	4
III	Allied B: Paper II [@]	4	3	20	55	75	3
III	Allied B: Practical [@]	2	3	20	30	50	2
IV	SkillbasedSubject2: Technology of Dyeing of Natural Fibers	2	3	25	25	50	2
IV	Tamil**/Advanced Tamil*(OR) Non-major elective-II (General Awareness*)	1	3	-	50	50	2
	Naan Mudhalvan Skill Course -Digital Skills for Employability – Office Fundamentals http://kb.naanmudhalvan.in/Special:FilePath/Microsoft_Course_Details.xlsx	2	-	25	25	50**	2
	Total	30		195	455	650	26
Semester V							
III	Core Paper VI (Inorganic Chemistry II)	5	3	25	75	100	4
III	Core Paper VII (Spectroscopy)	5	3	25	75	100	4
III	Core Paper VIII (Electro chemistry)	5	3	25	75	100	4
III	Core Paper IX (Analytical Chemistry)	4	3	25	75	100	4
III	Core Practical III (Gravimetric and Physical)	5	-	-	-	-	-
III	Elective I	4	3	25	75	100	4
IV	SkillbasedSubject3: Water & Effluent Treatment And Pollution Control	2	3	20	55	75	3
	Total	30		145	430	575	23
Semester VI							
III	Core Paper X (Organic Chemistry II)	6	3	25	75	100	4
III	Core Paper XI (Physical Chemistry II)	6	3	25	75	100	4
III	Core Practical III (Gravimetric and Physical)	5	6	25	75	100	4
III	Elective II	4	3	20	55	75	3
III	Elective III	4	3	20	55	75	3
III	Core Practical for Elective Subjects	3	3	20	55	75	3
IV	SkillBasedSubject4: (Textile Chemistry Practical)	2	3	20	30	50	2
	Naan Mudhalvan Skill Course- Employability Readiness – IBM Skills build	-	-	25	25	50	2
	Extension Activities [@]	-	-	25	-	25	1
	Total	30		205	445	650	26
	Grand Total	180		970	2530	3500	140

(A) Report: (40); (B) Attendance: (20); (C) Activities: (40)
Practice

*Observed During

Note

For subjects without practical.

@ For subjects with practical.

* No Continuous Internal Assessment (CIA). Only University Examinations.

** No University Examinations. Only Continuous Internal Assessment (CIA).

*** English II- University semester examination will be conducted for 50 marks (As per the existing pattern of Examination) and it will be converted for 25 marks.**

**** Naan Mudhalvan – Skill courses- external 25 marks will be assessed by Industry and internal 25 marks will be offered by respective course teacher.**

Semester IV Skill based Subject 2: Technology of Dyeing of Natural Fibers University examination will be conducted for 45 marks (As per the existing pattern of examination) and it will be converted for 25 marks

Allied Subjects (College scan choose any two subjects)		
1. Mathematics, 2. Physics, 3. Botany, 4. Zoology, 5. Biochemistry		
List of Elective papers		
(Colleges can choose any one of the papers as electives)		
***These elective papers are included in the curriculum as a part of industry4. O.		
Elective–I	A	Polymer Chemistry
	B	Agro Industrial Chemistry***
	C	Pharmaceutical Chemistry***
Elective–II	A	Leather Chemistry
	B	Chemistry of Plant Based Products
	C	Dye Chemistry
Elective–III	A	Analytical Chemistry II Lab Techniques***
	B	Environmental Chemistry
	C	Textile Chemistry***



First Semester

Course code	13A	GENERAL CHEMISTRY-I	L	T	P	C
CORE		Core I–Paper- I	6	1	-	4
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Explain the properties of periodic table and bonding theories						
2. Outline the reactivity of alkenes and alkynes and conformation of alkanes						
3. Describe the laws of thermodynamics and black body radiation						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the properties of period and groups in periodic table					K1, K2
2	Able to name the hydrocarbons and identify the products of elimination and addition reactions.					K2-K4
3	Discuss the various polar effects in alkanes and alkenes. Describe the preparation of cycloalkanes					K1-K3
4	Explain the theory of black body radiation					K1, K2
5	Understand the first and second law of thermodynamics					K1, K2
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Periodic Properties and Theory of Bonding				18hours
1. Periodic table-Introduction-Periodic properties- Ionization energy, Electron affinity, Electronegativity and their variations along the period and groups.						
2. Hybridization and geometry of BeCl ₂ , BF ₃ , CH ₄ , PCl ₅ , IF ₇ and SF ₆ . VSEPR Theory. Covalent Bond- Molecular orbital theory-application to molecules such as H ₂ ⁺ He ₂ , F ₂ , O ₂ , N ₂ , CO and NO.						
Unit:2						
Unit:2		Reaction of Alkenes and Alkynes				18hours
1. Nomenclature of acyclic alkane, alkene and alkyne.						
2. Alkenes: Preparation by Wittig reaction – Mechanisms of beta elimination – E1, E2 and CIS elimination – Hoffmann’s rule and Saytzeff’s rule. Addition reactions with hydrogen, halogen, hydrogen halide (Markownikoff ‘s rule) and hydrogen bromide (Peroxide effect). Dienes: Stability of isolated and conjugated dienes-1, 2 and 1, 4 additions, Diels -Alder reaction. Free Radical addition – Polymerization– synthetic rubber.						
3. Alkynes: Acidity of Alkynes – formation of acetylides-addition of water with HgSO ₄ catalyst-hydroboration.						
Unit:3						
Unit:3		Polar Effects and Conformations of Alkanes				18hours
1. Polar effects – inductive effect, mesomeric effect, electromeric effect, hyper conjugation and steric effects. Classification of reagents: Electrophiles, Nucleophiles and Free radicals. Types of reaction: Polar reactions involving carbonium ions and carbanions with simple examples.						
2. Aliphatic Hydrocarbons: Restricted rotation about single bond preferred rotational conformations.						
3. Cycloalkanes: Preparation by Dieckmann ring closure and by reduction of aromatic hydrocarbons– ring opening reactions of cyclopropane with H ₂ , Br ₂ and HI.						

Unit:4	Liquid Crystals and Black Body Radiation	18hours
1. Liquid crystals the concept of mesomorphic state - typical liquid crystalline substances and their properties. 2. Failure of classical theory in explaining black body radiation- Planck's theory of quantization of energy – Einstein's theory of photoelectric effect-Compton effect. de-Broglie theory of wave-particle dualism. Particle in one dimensional box (Wave length determination only) -Schrodinger equation.		
Unit:5	Laws of Thermodynamics	18hours
The laws of thermodynamics, generalities and Zeroth law – kinds of energy – Scope of the first and second laws of thermodynamics-thermodynamic terms-definitions–heat–work of expansion – work of compression – maximum and minimum quantities of work – Reversible and irreversible transformations of energy. First law of thermodynamics – properties of energy changes in relation to properties of system- isothermal and adiabatic changes – meaning of the thermodynamic state function–properties of exact and inexact differentials–Joule Thomson experiment		
	Total Lecture hours	90 hours
Text Book(s)		
1	Principles of Inorganic Chemistry, B. R. Puri L. R. Sharma, S. Chand &Co.	
2	Inorganic Chemistry, P. L. Soni, Sultan Chand &Sons.	
3	Organic Chemistry, Vol. 1, 2&3, S. M. Mughergee, S. P. Singh, R. P. Kapoor, Wiley Eastern.	
Reference Books		
1	Advanced Organic Chemistry, B. S. Bahl, Arunbahl, S. Chand &Co.	
2	Essentials of Physical Chemistry, B. S. Bahl and G. D. Tuli, S. Chand & Co.	
3	Textbook of Physical Chemistry, P. L. Soni, D. B. Dharmarke, S. Chand &Co.	
4	Principles of Physical Chemistry, B. R. Puri, L. R. Sharma and M. S. Phathania, S. Chand &Co.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/content/storage2/courses/104101005/downloads/LectureNotes/chapter%207.pdf	
2	https://www.youtube.com/watch?v=4LQ8jdKZTEo	
3	https://www.khanacademy.org/science/organic-chemistry/bond-line-structures-alkanes-cycloalkanes/conformations-alkanes-cycloalkanes/v/conformational-analysis-of-ethane	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	S	S	S	S
CO2	M	M	M	M	S	S	M
CO3	M	M	S	S	S	M	M
CO4	S	M	S	S	M	S	S
CO5	S	S	M	S	S	S	M

*S-Strong; M-Medium; L-Low



Second Semester

Course code	23A	GENERALCHEMISTRY-II	L	T	P	C
CORE		Core II–Paper - II	6	1	-	4
Pre-requisite		Higher Secondary Level Chemistry	Syllabus version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Outline the fundamentals of volumetric estimations						
2. Explain electrophilic and nucleophilic substitution reactions						
3. Describe the application of boron and silicate chemistry						
4. Discuss thermodynamics and solidstate chemistry						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the principles of volumetric analysis and estimate an unknown ion					K1, K2
2	Outline the structure and properties of boron and silicate compounds					K1, K2
3	Explain the aromatic electrophilic substitution and aliphatic nucleophilic substitution reactions with mechanism					K2-K4
4	Understand the relation between thermodynamic properties					K1-K3
5	Understand the packing and structure of crystals					K1, K2
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1		Volumetric Analysis and Redox Reactions			18hours	
1.Principles of Volumetric Analysis: Terms used in volumetric analysis primary and secondary standard substances, standardization of solutions.						
2. Concentration units: ppm, molality, Formality. molarity, mole fraction, normality, weight percent and volume percent. Determination of equivalent weight of acids, bases, oxidant, reductant and simple salts. Types of volumetric titrations, acid- base, redox, precipitation and complexometric titrations.						
3. Indicators: Effect of change in pH, neutralization, redox, adsorption and metal ion indicators.						
4. Oxidation and reduction reactions: balancing redox equations by oxidation number and ion-electron method.						
Unit:2		Boron and Silicates			18hours	
Chemistry of Boron–Group discussion –Electron acceptor behavior and electron deficiency of boron hydrides; bonding in diboranes; NaBH ₄ and borazole- preparation, properties, structure and uses. Silicates-Classification of silicate- simple silicates, chain silicates and sheet silicates only.						
Unit:3		Electrophilic and Nucleophilic Substitution			18hours	
Structure of benzene- Aromaticity -Huckel's rule. Electrophilic substitution in benzene with mechanism -Nucleophilic substitution reaction – SN ₁ , SN ₂ and SN _i reactions - Grignard reagent and synthetic applications-Elimination versus substitution- Benzyne mechanism and intermediate complex mechanism.						

Unit:4	Thermodynamics	18hours
Relation between E and H, C _p and C _v . The heat of reaction – conventions in the values of H. Hess's law – heats of combustion – determination by Bomb Calorimeter – Bond energies – Resonance energies – Heats of solution – integral and differential heat of dilution – Heats of reaction at constant volume–dependence of the heat of reaction on temperature and Kirchoff's equation.		
Unit:5	Solid State Chemistry	18hours
Crystalline and amorphous solids, crystal systems, Bravis lattice, unit cell, law of rational indices (Weiss indices), Miller indices,Symmetry elements in crystals (for cubic system only). X- ray diffraction by crystals - derivation of Bragg's equation - Bragg method - powder method. Crystal structure of NaCl, Wurzite, CaF ₂ and TiO ₂ -radius ratio rules and packing in crystals.		
	Total Lecture hours	90hours
Text Book(s)		
1	Principles of Inorganic Chemistry, B. R. Puri L. R. Sharma, S. Chand &Co.	
2	Text book of Physical Chemistry, P. L. Soni, D. B. Dharmarke, S. Chand &Co.	
3	Essentials of Physical Chemistry, B. S. Bahl and G. D. Tuli, S. Chand &Co.	
Reference Books		
1	Inorganic Chemistry, P. L. Soni, Sultan Chand &Sons.	
2	Advanced Organic Chemistry, B. S. Bahl, Arun Bahl, S. Chand & Co.	
3	Physical chemistry, G. N. Castellan, Addison-Wesley Pub. Co.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://web.iit.edu/sites/web/files/departments/academic-affairs/academic-resource-center/pdfs/SN1_SN2. pdf	
2	https://nptel.ac.in/content/storage2/courses/104101005/downloads/LectureNotes/chapter%20 9. pdf	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	S	S	S	S
CO2	M	M	M	M	S	S	M
CO3	M	M	S	S	S	M	M
CO4	S	M	S	S	M	S	S
CO5	S	S	M	S	S	S	M

*S-Strong; M-Medium; L-Low

Course code	23P	INORGANIC QUALITATIVE ANALYSIS	L	T	P	C
CORE		CORE III-CHEMISTRY PRACTICAL	-	-	3	4
Pre-requisite		Higher Secondary Level Practical Knowledge	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Impart knowledge to the students in handling laboratory equipment and reagents						
2. Improve the skill of inorganic mixture analysis.						
3. Make the students to analyze and identify the cations and anions in the mixture of salts.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Do preliminary tests and identify interfering and non-interfering radicals and confirm their presence				K1-K5	
2	Remove interfering anions, carry out a systematic analysis and identify the cations in a given sample				K1-K5	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Part I		ANALYSIS OF CATIONS			45 hours	
CATIONS TO BE STUDIED: Lead, Copper, Bismuth, Cadmium, Iron, Aluminum, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.						
Part II		ANALYSIS OF ANIONS			45 hours	
ANIONS TO BE STUDIED: Carbonate, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate, and Phosphate.						
		Total Practical hours			90 hours	
Text Book(s)						
1	Basic Principles of Practical Chemistry, Kulandaivelu A.R. Veeraswamy R., Venkateswaran, Sultan Chand & Sons, 2017.					
2	Practical Chemistry for B. Sc Chemistry, A. O. Thomas					
Reference Books						
1	A Text Book of Qualitative Analysis including semi- micro methods, A. I. Vogel.					
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]						
1	https://www.youtube.com/watch?v=O9ba90MJws0					
2	https://www.youtube.com/watch?v=oz1LNi90SSU					
3	https://www.youtube.com/watch?v=QQo1e-BUZW5					
Course Designed By: Dr. S. Karthikeyan						

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	M	S	M	S
CO2	S	M	S	S	M	S	S

*S-Strong; M-Medium; L-Low



Third Semester

Course code	33A	INORGANIC CHEMISTRY-I	L	T	P	C
CORE		Core IV–Paper III	3	-	-	4
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Explains the fundamental concepts involved metallurgical process for extraction of metals.						
2. Discuss the theories and stability of metal complexes.						
3. Outline the importance of organometallic compounds and their catalytic applications.						
4. Describe the structure & functioning of biomolecules and role of metals in biology						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Explain various chemical and electrochemical principles involved in the extraction of metals.					K1, K3
2	Make use of the occurrence and extraction of important metal and their compounds					K2, K3
3	Outline the importance of solvents and solubility in chemical reactions					K2
4	Define and classify the structure and properties of organometallic compounds					K1-K3
5	Describe the structure & functioning of biomolecules and role of metals in biology					K1, K2
K1-Remember; K2 -Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1		Methods of Extraction			9hours	
General methods of Extraction: Concentration – Gravity separation, Froth Flotation, magnetic separation, Extraction – Chemical and Electrolytic methods of refining, Zone refining, Van Arkel refining and Electrolytic refining with examples. Occurrence, extraction, properties and uses of Germanium and Titanium and their important compounds such as GeCl ₄ and TiO ₂ .						
Unit:2		Extraction of Metals and Their Compounds			9hours	
Occurrence, extraction, properties and uses of Zirconium, Vanadium, Molybdenum and Tungsten-their important compounds such as V ₂ O ₅ , ZrOCl ₂ , (NH ₄) ₂ MoO ₄ , WO ₂ , and tungsten bronzes.						
Unit:3		Role of Solvents			9hours	
The solvents- solubility of compounds – effect of temperature on solubility – Role of water as solvent- chemical structure and solubility. Classifications of solvents – general behavior – properties of ionizing solvents. Types of reactions in non-aqueous solvents–protonic solvents –ammonia, hydrogen fluoride. Non-Protonic solvents-SO ₂ and BrF ₃ . Organic solvents–C ₂ H ₅ OH and Ether.						

Unit:4	Organo metallic Compounds	9hours
Definition–Nomenclature of Organo metallic compound Synthesis of organometallic compounds of Be, Mg, Zn, B and Al – Ferrocene: Preparation – Aromaticity of: Ferrocene, cyclic C _n H _n Ligands–Application of: Grignard reagent and Gilman Reagent-alkene polymerization using Ziegler-Natta catalyst.		
Unit:5	Bio inorganic Chemistry	9hours
Importance of metals in biological systems – chemistry of hemoglobin and myoglobin –Role of: Na ⁺ and K ⁺ ions – Mg ²⁺ and Ca ²⁺ ions – Biological functions and toxicity of trace elements: Cr, Mn, Co, Ni and Cu–Ultra trace elements: As, Se, Mo, I, Fe and Zn– Biological fixation of nitrogen–Metallo -enzymes: Carbonic anhydrase, Carboxy peptidase.		
	Total Lecture hours	45hours
Text Book(s)		
1	Principles of Inorganic Chemistry, B. R. Puri L. R. Sharma, S. Chand &Co.	
2	Principles of Inorganic Chemistry, B. R. Puri, L. R. Sharmaand K. C. Kalia, Milestone Publishers (2012)	
3	Inorganic Chemistry, P. L. Soni, Sultan Chand &Sons.	
Reference Books		
1	Huheey, J. E.; Keiter, E. A.; Keiter, R. L. Inorganic Chemistry, Principles of Structure andReactivity, 4thed., Harper Collins, 1993.	
2	Lee. J. D, Concise Inorganic chemistry, Vedition, Chapman &Hall Ltd, London, 2000	
3	Shriver, D. F.; Atkins, P. W.; Langford, C. H. Inorganic Chemistry, 3rded., Oxford University Press, 2000.	
4	Cotton, F. A.; Wilkinson, G.; Murillo, C. A.; Bochmann,M. Advanced Inorganic Chemistry, 6thed., JohnWiley, 1999.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/content/storage2/courses/104101005/downloads/LectureNotes/chapter%207.pdf	
2	https://youtu.be/BZ_tY88o0oI , Co-ordinationchemistry, IIT Kharagpur, Prof. D. Ra Y.	
3	https://youtu.be/FziKko-ZQww forbioinorganicchemistry.	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	S	S	S	S
CO2	M	M	S	M	S	M	S
CO3	S	M	S	M	S	S	S
CO4	S	M	M	M	M	S	S
CO5	S	M	M	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code	33B	PHYSICALCHEMISTRY-I	L	T	P	C
CORE		Core V– Paper IV	3	-	-	4
Pre-requisite		Basics of Physical Chemistry	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Enable the students in understanding the second and third law of thermodynamics						
2. Explain various system in phase rule and their application						
3. Application of the computer C programming in chemistry						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of thermodynamics, Second law, and Entropy change.					K1, K2
2	Understand the Spontaneity and its conditions, Gibb’s free energy and knowledge of third law.					K2, K3
3	Understand the concepts of Phase rule and its applications to various systems.					K2-K4
4	Know the different laws of solutions and evaluate the Colligative properties					K3, K5
5	Understand the C- Programand evaluate the various parameters.					K2, K5
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Thermodynamics I			9hours	
Need of second law of thermodynamics – Carnot cycle – entropy – Definition – Entropy changes in isothermal transformation –Trouton’s rule. Entropy as function of T and V–Entropy as a function of T and P–Changes of entropy with T, Entropy changes in ideal gas–entropy of mixing of ideal gases.						
Unit:2						
Unit:2		Thermodynamics II			9hours	
General conditions of equilibrium and spontaneity- conditions of equilibrium and spontaneity– definition of A and G – physical significance of dA and dG - Temperature and pressure dependence of G – Gibbs – Helmholtz equation. Chemical equilibrium – The conceptofchemicalpotential–chemicalpotentialinamixtureofidealgases–Van’tHoffIsotherm, and isochore – Third law of thermodynamics – statement and applications - Exception to third law.						
Unit:3						
Unit:3		Phase Rule			9hours	
Phase equilibria – equilibrium condition - Stability of phase of a pure substance – Pressure dependence of μ and T curves. The Clapeyron and Clapeyron-Clausius equations. Derivation of Gibbs phase rule. Phase equilibria in one component system – Water and Sulphur systems. Reduced phase rule – Phase diagram for two component system – construction of the phase diagram -Thermal analysis method–Phase Diagram of Simple eutectic systems: Pb-Ag System- extraction of Silver from Argentiferous Lead, Compound forming type–Congruent melting point: Zn-Mg, Incongruent melting point: Na-K systems.						

Unit:4	Solutions	9hours
Ideal and non-ideal – Raoult’s law- Positive and negative deviation Henry’s law – Nernst distribution law and its applications. Colligative properties- relative lowering of vapor pressure, elevation of boiling point, depression of freezing point and osmotic pressure-their applications.		
Unit:5	C Program for Chemistry	9hours
Structure of C program, Variables in C, Keywords and constants in C, Operators in C– Arithmetic, Increment, Decrement, relational and logical operators - Program: To calculate the pH of solutions– Calculation of pH of solution using Henderson equation- to compute the rate constant of a first order reaction–to compute half – life period of a reaction–to compute the Energy of activation of a reaction.		
	Total Lecture hours	45hours
Text Book(s)		
1	Principles of physical chemistry, B. P. Puri, L. R. Sharmaand M. S. Phathania, S. Chand & Company	
2	Physical chemistry G, W. Castelan, Narosa Publishers.	
3	Physical chemistry (Vol. II)–N. B. Singh, Shivasaran Das, A. K. Singh– New Age International Publishers–First edition (2009)	
Reference Books		
1	Elements of Physical Chemistry, Puri Sharma, Pathania, 2013-14Edn., Vishal Publishing Co. Jalandhar, Delhi.	
2	Principles of Physical chemistry, Puri Sharma Pathania, 46 th Edn. Vishal Publishing Co. Jalandhar	
3	Computer for Chemists– By Pundir Bansal – Pragati Prakasam Pubs.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/112/108/112108148/	
2	https://www.youtube.com/watch?v=2LywAiZBQW4	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	M	L	S	S	M
CO2	S	L	S	M	M	S	S
CO3	M	S	M	L	L	M	M
CO4	S	S	M	M	S	L	L
CO5	M	S	L	M	M	S	M

*S-Strong; M-Medium; L-Low

Course code	3ZA	CHEMISTRY OF NATURAL AND SYNTHETIC FIBERS	L	T	P	C
SBS		Skilled Based Subject – I	2	-	-	3
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Detail explanation of the classification of natural fiber, its merits and demerits						
2. Outline about the preparation, properties and uses of viscose, synthetic and acrylic fiber						
3. Describe the reaction of nylon and polyester fiber						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To understand the classification, properties and uses of natural fibers.					K1, K2
2	Able to know about the chemical structure of cellulose fiber. Wet spinning process.					K1– K3
3	Discuss about synthetic and acrylic fiber. Detail about fiber forming polymer and schio process.					K1, K2, K4, K6
4	Explain the naming reaction of nylon fiber. Explanation of structure and uses of Kevlar fiber.					K1, K2
5	Discuss about polyester fiber. Synthesis of DMT, ethyleneglycol and PET					K1, K3, K4
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Natural Textile Fibers				6hours
Natural Textile Fibers: Definition, Classification of Natural Textile Fibers-Vegetable fibers, Animal fibers. Properties, Uses and Features of Cotton, Wool, Silk and Jute fibers. Genetically Modified Cotton: its merits and demerits.						
Unit:2						
Unit:2		Viscose Fiber				6hours
Viscose Fibre: Chemical structure, chemistry of regenerated cellulose. Production of Viscose Fibre: a simple flow chart, wet spinning of viscose filaments. Properties and uses of Viscose Fibre.						
Unit:3						
Unit:3		Synthetic and Acrylic Fibers				6hours
Synthetic Fibers: Definition of monomers, polymers and polymerization. Simple examples of Condensation and Addition Polymerization reactions. Criteria for fibre forming polymers. Acrylic fibers: Synthesis of Acrylonitrile from propylene (Sohio Process), solution polymerization of acrylonitrile. Properties and uses of acrylic fibers.						
Unit:4						
Unit:4		Nylon Fibers				6hours
Nylon Fibers: Synthesis of caprolactum from aniline, adipic acid from cyclohexane and hexa methylene diamine from adiponitrile. Poly condensation reactions leading to the formation fNylon6 and Nylon6, 6. Properties and uses of Nylon fibers. Structure and uses Of Kevlar fibers.						

Unit:5	Reaction of Polyester Fibers	6hours
Polyester Fibers: Synthesis of Dimethyl Terephthalate (DMT) from p – xylene, terephthalic acid from benzoic acid (Henkel- II process) and synthesis of ethylene glycol. Chemical reactions of Poly Ethylene Terephthalate (PET) Preparation, properties and uses of Poly ester fibers.		
	Total Lecture hours	30hours
Text Book(s)		
1	Moses, J. Jeya kodi and M. Ramasamy. "Quality Improvement on Jute and Jute Cotton Materials Using Enzyme Treatment and Natural Dyeing". <i>Man-Made Textiles in India</i> . Vol. 47, no. 7 (Jul. 2004): 252–255. (AN14075527)	
2	"cotton". The Columbia Encyclopedia, Sixth Edition. 2001-07.	
3	A.A. Vidya,ed.: Production of Synthetic Fibers, Prentice-Hallof India, 1988, New- Delhi.	
Reference Books		
1	Stephen Yafa (2004). <i>Cotton: The Biography of a Revolutionary Fiber</i> . Penguin (non-classics), 16. ISBN0-14-303722-6.	
2	Kadolph, Sara J., ed.: <i>Textiles</i> , 10th edition, Pearson/Prentice-Hall, 2007, ISBN0-13-118769-4.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]		
1	https://www.youtube.com/watch?v=ypUkIR894AM	
2	https://www.youtube.com/watch?v=0hoHvN289Xs	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	M	S	M	S	S	S	M
CO3	S	M	S	S	S	M	M
CO4	S	M	S	S	M	S	S
CO5	S	S	M	S	S	S	S



Fourth Semester

Course code	43A	ORGANIC CHEMISTRY-I	L	T	P	C
CORE		Core VI– Paper V	4	-	-	4
Pre-requisite		Basics of Organic Chemistry	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Understand the carbonyl compound' s reactivity and various reduction reactions						
2. Explain the reactivity of active methylene compounds with electrophiles						
3. Outline the reactivity of monohydric alcohol sand amines.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Know the knowledge of Preparation and Properties of Carbonyl Compounds.					K1
2	Understand the mechanism of certain name reactions.					K2, K3
3	Understand the concepts of active Methylene compounds and Geometrical isomerism of certain organic compounds.					K2, K4
4	Know the classification of Phenols, Preparation of phenolic compounds with chemical properties.					K2
5	Know the concepts of amines, types, separation and their basic nature.					K3, K4
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
		Chemistry of Carbonyl Compounds–I	12hours			
Nomenclature, Preparation &Properties: Structure of carbonyl-general physical properties -Reaction with: Grignard reagent, NH ₃ , primary amine Reaction Mechanism of haloform reaction, Reformatsky reaction. Reduction Reactions: with LiAlH ₄ and NaBH ₄ –Clemmensen reduction, Wolff Kishner reduction, MPV reduction						
Unit:2						
		Chemistry of Carbonyl Compounds–II	12hours			
Mechanism of: -Aldol condensation, Cannizzaro reaction, Perkin reaction, Knoevenagel reaction, Claisen-Schmidt reaction, benzoin condensation, Mannich reaction.						
Unit:3						
		Active Methylene Compounds	12hours			
Acetoacetic ester: preparation from Ethyl acetate – synthesis of succinic acid, 1, 3-diketones, antipyrine - Malonic ester: Preparation from potassium cyanoacetate – synthesis of cinnamic acid, keto acids, barbituric acid- cyano acetic ester: preparation from chloroacetic acid– synthesis of malonic acid and adipic acid-Tautomerism of acetoacetic ester. Geometrical isomerism: Cis & Trans, E & Z notations–Geometrical isomerism in maleic acid and fumaric acid-physical and chemical properties of geometrical isomers.						

Unit:4	Phenols	12hours
Classification of phenols–Preparation of phenol from chlorobenzene, cumene– Reaction with mechanism: Schotten – Bauman and Gattermann reactions Di and Trihydric phenols: Preparation of Catechol, Resorcinol, Quinol, Pyrogallol and Phloroglucinol– Houben -Hoesch reaction		
Unit:5	Amines	12hours
Preparation of aliphatic and aromatic primary, secondary and tertiary amines – their separation, comparison of their basicity Reactions of Aromatic Amine: ring substitution, diazotization and coupling reaction– Diazomethane: preparation and synthetic applications		
	Total Lecture hours	60hours
Text Book(s)		
1	Advanced Organic Chemistry, B. S. Bahl, Arunbahl, S. Chand & Co.,	
2	Textbook Organic Chemistry, P. L. Soni, S. M. Chawla, Sultan Chand & Sons	
Reference Books		
1	Stereo chemistry, Conformation and mechanisms, Kalsi, Wiley-Eastern Ltd.,	
2	Organic chemistry, R. T. Morrison and R. W. Boyd, Prentice–Hall.	
3	Fundamentals of Organic Chemistry, T. W. Graham Solomen, John-Wiley & Sons	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/content/storage2/courses/104101005/downloads/LectureNotes/chapter%2010.pdf	
2	https://www.youtube.com/watch?v=JgmzmehMiWM	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	M	L	M	M	L
CO2	M	L	S	L	L	M	M
CO3	L	M	S	M	L	L	S
CO4	S	M	S	L	M	M	L
CO5	S	L	M	M	L	M	L

*S-Strong; M-Medium; L-Low

Course code	43P	VOLUMETRIC AND ORGANIC ANALYSIS	L	T	P	C
CORE PRACTICAL		CORE VII-CHEMISTRY PRACTICAL II	-	-	3	3
Pre-requisite		Basics Knowledge on Volumetric and Organic Reactions	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
<div><div>1.</div><div>Inculcate the students how to skilfully handle the laboratory equipment, reagents, lab apparatus and preparation of standard solutions.</div></div> <div><div>2.</div><div>Impart the first- hand knowledge and experience on estimation of anion, acid and base both directly as well as indirectly.</div></div> <div><div>3.</div><div>Provide the student knowledge on analysis of an unknown organic substance using Preliminary and confirmation test and prepare a suitable derivative.</div></div> <div><div>4.</div><div>Make the students skilful enough and prepare for a position in an analytical laboratory or a company.</div></div>						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Estimate the amount of ion present in the given solution through volumetric analysis both by direct and indirect method				K1-K6	
2	Find the groups/elements and characters present in the given organic Substance through qualitative analysis and prepare a suitable derivative.				K1-K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Part I		VOLUMETRIC ANALYSIS	45hours			
A. Acidimetry & Alkalimetry: Estimation of Na_2CO_3						
B. Permanganometry:						
<div><div>1.</div><div>Estimation of Ferrous sulphate & Oxalic acid</div></div> <div><div>2.</div><div>Estimation of Calcium- Direct method.</div></div>						
C. Dichrometry: Estimation of Ferrous iron using internal indicator.						
D. Iodimetry:						
<div><div>1.</div><div>Estimation of $\text{K}_2\text{Cr}_2\text{O}_7$</div></div> <div><div>2.</div><div>Estimation of Copper.</div></div> <div><div>3.</div><div>Estimation of As_2O_3.</div></div>						
Part II		ORGANIC ANALYSIS	45hours			
Systematic analysis of an organic compound Preliminary tests, detection of elements present, Aromatic or Aliphatic, Saturated or unsaturated, nature of the functional group, confirmatory tests and preparation of derivatives.						
Substances-Aldehydes, Ketones, Amines, Amides, Diamide, Carbohydrates, Phenols, Acids, Esters & Nitro compounds.						
		Total Practical hours		90hours		

Text Book(s)	
1	Basic Principles of Practical Chemistry, Kulandaivelu A. R., Veeraswamy R. Venkateswaran, Sultan Chand & Sons, 2017.
2	Practical Chemistry, Pandey D. N., Sultan Chand Publishers, 2018
Reference Books	
1	Vogel's Text book of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Fifth Edition, Bath Press, Great Britain, 1989
2	Vogel's Textbook of Quantitative Chemical Analysis, GH Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britain, 1989
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/104/106/104106108/
2	https://www.youtube.com/watch?v=n4esSHxz_J8
3	http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html/
4	https://www.youtube.com/watch?v=7bmQkQW8bbs
5	https://www.youtube.com/watch?v=wRAo-M8xBHM
Course Designed By: Dr. S. Karthikeyan	

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S

Course code	4ZB	TECHNOLOGY OF DYEING OF NATURAL FIBERS	L	T	P	C
SBS		Skilled Based Subject–II	2	-	-	2
Pre-requisite		Basic Knowledge in Fibers	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. To impart knowledge and skill in career oriented with a special reference to dyeing textile industry.						
2. To help students to acquire additional knowledge of dyeing auxiliaries and methods used in textile industry.						
3. To give students an overview on process and mechanism of dyeing.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	State the basic aspects of colour and dyeing auxiliaries.					K2, K4,
2	Outline various methods of dyeing.					K2, K3
3	Demonstrate the process of azoic dye and their applications.					K2, K3
4	Acquire knowledge in vat dyes and the procedures followed for dyeing.					K2, K3
5	Summarize the properties and mechanism of dyeing particularly sulfur and acid dyes.					K3, K4, K5
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Introduction to Dyeing						
6hours						
Theory of Colour, chromophore, auxochrome, chromogen. Primary and Secondary colour. Chromatic and Achromatic Colours – Classification of dyes. Definition– Affinity, Substantivity, Exhaustion, %Shade, Adsorption, Diffusion, Aggregation, Migration– Effects of M:L ratio, salt, time and temperature. of dyeing. Properties of direct dyes – Application of direct dyes of Cotton: Mechanism of dyeing. Stripping and Redyeing. After treatment with CuSO ₄ , K ₂ Cr ₂ O ₇ and dye fixing agents.						
Unit:2						
Methods of Dyeing						
6hours						
Reactive dyes – properties, Cold Brand, Hot Brand, Vinyl sulphone dyes, LS dyes, HE dyes, bi functional dyes, Mechanism of dyeing. Exhaust dyeing, pad-batch, pad-steam, pad-cure, pad-silicate Methods. Stripping and redyeing.						
Unit:3						
Naphthols and Fast Bases						
6hours						
Naphthols and Fast Bases: properties and application– Diazotisation and coupling. Brief study on dissolution (classification of naphthols, cold and hot dissolution methods). Bases –direct and indirect method of diazotization. Application procedure of any one naphthols and base using Jigger and pad-dry-develop method. Stripping and Redyeing.						
Unit:4						
Vat Dyes						
6hours						
Types of Vat dyes. Details of vatting, dyeing, oxidation and soaping. Application procedure :Leuco vat, vat acid–pigment padding–pad steam process. Merits and demerits of above methods. Dyeing of yarn with vat dyes by conventional method.						

Unit:5	Properties and Application of Dyes	6hours
Brief study–solubilized vat dyes–properties–advantages and disadvantages over vat dyes –application–exhaust dyeing method. Sulphur dyes–Properties of Sulphur dyes–application. Jigger and continuous dyeing defects. Bronziness and acid tendering – Stripping and redyeing. Use of hydros. Properties of basic dyes mordants used for cotton. Dyeing wool & silk with basic dyes. Eco-friendly sulphur dyeing. Acid dyes – Properties, classification of dyes – leveling acid dyes, milling acid dyes – super milling acid dyes – application to wool and silk. Mechanism of dyeing– Dyeing of nylon with acid dyes.		
Total Lecture hours		30hours
Text Book(s)		
1	Shenai V. A., Technology of Textile Processing Vol. 1 and2, Chemistry of Dyes and Principle of Dyeing Ed. 3, 1983, Sevak Publication, 306, Sri Hanuman Industrial Estate, GC Ambedkar Road, Wadala, Bombay400031.	
2	Chakravarthy RR and Trivedi S. S., Technology of Bleaching and Dyeing of Textile Fibre Vol 1, Part 1, 1979 Mahajan Book Publishers, Supermarket Basement, Near Nataraj Cinema, Ashram Road, Ahmedabad 380009.	
3	Srivastava SB, Recent Process of Textile Bleaching, Dyeing and Finishing, 1981, SB Srivastava, SBP Board Consultant, SBP Buildings, 4/45Roopnagar, Delhi110007.	
Reference Books		
1	Trotman E. R, Dyeing and Chemical Technology of Textile Fibre, Charles Griffin &Co, 42, Dhurylane, LondonWC2	
2	Gokhle S. V. and Shah. R. C., Cotton Piece dyeing, 1981, Ahmedabad Textile Industrial Research Assn. (ATIRA), POPolytechnic, Ahmedabad380015.	
3	Prayag R. S.,The bleaching and dyeing of Cotton material 1983, Weaver's ServiceCent., 15A, Mam paraman and Marg, Near Roxy Cinema, Bombay400 004.	
4	D. M. Lewis, Wool Dyeing, SDC Publications, UK.	
5	J. K. Aspland, Textile Dyeing and Colouration, AATCC Publications, USA.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.swayam2.ac.in/cec19_te01/preview	
2	https://www.classcentral.com/course/swayam-textile-finishing-14326	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	M	M	S	S	S
CO3	S	M	S	M	S	S	S
CO4	S	S	M	M	S	M	S
CO5	S	S	M	M	M	M	S

*S-Strong; M-Medium; L-Low



Fifth Semester

Course code	53A	INORGANICCHEMISTRY-II	L	T	P	C
CORE		Core VIII– Paper-VI	5	-	-	4
Pre-requisite		Basics of Inorganic Chemistry	Syllabus version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. To acquire knowledge on nuclear reactions, reactivity of atom bomb and hydrogen bomb, the importance of nuclear reactors in production of electricity.						
2. To describe the structure of metals and alloys along with its classifications and to impart basics on semiconductors along with its uses.						
3. To develop chemistry knowledge on isotopes, the importance of radioactive compounds in food preservation, archaeological dating and medical diagnosis and treatment.						
4. To study about the concepts related to the coordination compounds.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Rationalise the conductivity of metals, semiconductors along with its applications.					K1, K2, K3
2	Understand the types of nuclear reactions and its importance in generation of electricity.					K1, K2
3	Acquire enormous knowledge on uses of isotopes and radioactive substances.					K1, K2
4	Understand the terms - ligand, chelate, coordination number and various types of isomerism possible in coordination compounds.					K3, K4
5	Outline various theories Of coordination compounds and complete understanding on Crystal Fieldand Valence Bond Theory.					K2, K3
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Metals and Solid Solutions			15hours	
Structure of metals and alloys-substitutional and interstitial solid solution- Hume Rothery ratios- metallic bonding-electrical, optical and mechanical properties of metals-semiconductors, intrinsic and extrinsic-their uses. Superconductors-An elementary treatment.						
Unit:2						
Unit:2		Radioactivity and Nuclear Reactions			15hours	
Artificial radio activity. Artificial transmutation of elements, synthesis of radio isotopes and nuclear fission and fusion. Nuclear reactors – principle of working – production of electrical energy – atomic projects in India – Safety measures; disposal of reactor wastes – pollution. Nuclear reactions, mechanisms and different types of stellar energy.						
Unit:3						
Unit:3		Isotopes and Their Applications			15hours	
Nature of isotopes and isobars–detection and isolation of isotopes–various methods– Importance of discovery of istopes–uses of isotopes in various fields. Nuclear stability n/p ratio, magic numbers, C-12atomic weight scale, C-14 dating, mass defect and nuclear						

Binding energies. Radioactive disintegration series.		
Unit:4	Co-ordination Chemistry -I	15hours
Co-ordination chemistry – I Types of ligands, IUPAC Nomenclature, Isomerism - Ionisation, hydrate, linkage, ligand and coordination isomerism. Stereoisomerism - geometrical and optical isomerism in 4 & 6 coordinated complexes. Theories of coordination compounds –Werner’s and Sidgwick’s EAN concept, Valence Bond theory – hybridization, geometry and magnetic properties of $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{NiCl}_4]^{2-}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{CoF}_6]^{3-}$.		
Unit:5	Co-ordination Chemistry -II	15hours
Limitations of valance bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planner complexes, low spin &high spin complexes, factors affecting the crystal-field parameters. Explanation of colour and magnetic properties using CFT, comparison of VBT and CFT. A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, stability constants of Complexes and their determination, substitution reactions of square planar complexes.		
	Total Lecture hours	75hours
Text Book(s)		
1	Malik, Wahid U., G. D. Tuliand R. D. Madan. Selected Topics in Inorganic Chemistry, 7th ed., New Delhi S. Chand & Company Ltd., 2007.	
2	B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, ShobanLal Nagin Chandand Co., Delhi, 1996.	
3	H. J. Arnikar, EssentialsofNuclearChemistry, 4thed., NewAge International, NewDelhi, 1995.	
Reference Books		
1	J. E. Huheey, E. A. Kieterand R. L. Keiter, Inorganic Chemistry, 4thed., HarperCollins, New York, 1993.	
2	F. A. Cotton, G. Wilkinson, C. Murilloand M. Bochman, Advanced Inorganic Chemistry, 6thed., John Wiley, New York, 1999.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/104/105/104105033/	
2	https://www.encyclopedie-environnement.org/en/physics/radioactivity-and-nuclear-reactions/	
Course Designed By: Dr. S. Karthikeyan		

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	M	S	M	S	S
CO2	M	M	M	M	S	S	M
CO3	S	M	S	M	S	M	M
CO4	M	M	S	S	S	M	M
CO5	S	S	M	M	S	M	S

*S-Strong; M-Medium; L-Low

Course code	53B	SPECTROSCOPY	L	T	P	C
CORE		COREIX-PAPERVII	5	-	-	4
Pre-requisite		Knowledge on basic structure and reactions of simple organic compounds.	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Understand the basic concepts and theory behind the principles of different spectroscopic methods.						
2. Study the instrumentation and applications of UV-Visible, IR, Raman, NMR, Mass and ESR spectroscopic techniques.						
3. Predict the structure of organic compounds using IR, NMR and mass spectrometry.						
Expected Course Outcomes:						
On the successful completion of the course, students will be able to:						
CO1	Gain the knowledge of different electromagnetic radiations, basic concepts, instrumentation and applications of UV-Visible spectra.					K2, K3
CO2	Know different types of vibrational frequencies, comparison between IR and Raman spectroscopy as well as their applications.					K2, K3
CO3	Study the basic principles, instrumentation and applications of NMR spectroscopy pertaining to some simple organic compounds.					K2, K3, K4
CO4	Acquire the knowledge on the basic concepts, instrumentation and applications associated with ESR.					K2, K3, K4
CO5	Understand the different concepts of mass spectrometry along with the determination of molecular formula.					K2– K5
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Ultra Violet–Visible Spectroscopy	15hours			
Spectroscopy: Absorption and Emission spectra – Fundamental concepts – Electromagnetic spectrum with relative energies in each region.						
Ultra Violet – Visible Spectroscopy: Introduction – Beer–Lambert’s law – Instrumentation (block diagram)–Formation of absorption bands–Theory–Types of ElectronicTransitions						
– Transition probability – The Chromophore and Auxochrome concepts – Absorption and Intensity shifts (Bathochromic, hypsochromic, hyperchromic and hypochromic shifts) – Types of absorption bands– Frank Condon principle –Applications of UV– Visible spectra.						
Unit:2						
Unit:2		IR and Raman Spectroscopy	15hours			
IR Spectroscopy: Principle – Types of molecular vibrations–Vibrational frequencies– Factors affecting vibrational frequencies –Instrumentation (block diagrams with description of components) – Finger print region – Characteristic absorption bands of various functional groups– Applications of IR spectra.						
Raman Spectra: Theory - Comparison of IR and Raman spectra – Applications of Raman Spectra.						

Unit:3	NMR Spectroscopy	15hours
Introduction and basic principles–Spin–Spin relaxation, Spin–lattice relaxation–Instrumentation (Block diagram) – Chemical shift – Importance of TMS – Factors influencing chemical shift – Shielding and deshielding effects– Number of signals – Applications of NMR to simple molecules like Ethyl alcohol (Pure and Impure), Toluene, Phenol, Acetaldehyde and Diethyl ether.		
Unit:4	ESR Spectroscopy	15hours
Basic Principle–The g factor–Hyperfine splitting –Instrumentation–Applications to methyl radical and Naphthalene negative ion.		
Unit:5	Mass Spectrometry	15hours
Basic Principles–Theory–The molecular ion–Determination of molecular formula– McLafferty rearrangement–Metastable peaks–Nitrogen rule–Retro Diels –Alder reaction.		
	Total Lecture hours	75hours
Text Book(s)		
1	Elementary Organic Spectroscopy (Principles and chemical applications)–Y. R. Sharma, S. Chand &Company Ltd. Publications, Fifth revised Edn, 2017.	
2	Organic Spectroscopy (Principles and Applications)–Jag Mohan, Narosa Publishing House, Second Edn, 2012.	
Reference Books		
1	Spectroscopy of Organic compounds–P. S. Kalsi, New Age International Ltd. Publishers, Sixth Edn, 2005.	
2	Analytical Chemistry (Theory and Practice)–U. N. Dash, S. Chand & Sons, Second Edition, 2005.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://ndl.iitkgp.ac.in/	
2	https://nptel.ac.in/course.html	
3	https://ocw.mit.edu/	
	https://www.oercommons.org/advanced-search	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	M	M	S	M
CO2	M	S	S	S	M	S	S
CO3	S	S	H	S	M	S	S
CO4	M	M	M	M	L	M	M
CO5	M	S	M	M	M	S	M

*S-Strong; M-Medium; L-Low

Course code	53C	ELECTRO CHEMISTRY	L	T	P	C
CORE		Core X– Paper VIII	5	-	-	4
Pre-requisite		Higher Secondary Level Knowledge	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Make the students understand basic electro chemical principles						
2. Give them an insight into the types of storage cells & their applications						
3. Enable the student to understand the construction & working of different types of electrodes						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Describe the principle of solubility product and relate the pH of a solution containing a mixture of the two components to the acid dissociation constant, K_a					K1-K3
2	Understand the difference between metallic conductance & electrolytic conductance					K1, K2
3	Recognize the different types of electrochemical cells and calculate the cell potential from standard cell potential					K2, K3
4	Distinguish between cells and use the Nernst equation for calculating EMF of a cell.					K1-K4
5	Understand the working principles of fuel cells, storage cells and battery design.					K2-K4
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Ionic Equilibrium			15hours	
Ionic Equilibria- Solubility and solubility product-determination of solubility product-Applications of solubility product principle. Dissociation of weak acids and bases- Dissociation constants- pH scale- common ion effect-buffer solutions-Determination of pH values of buffer mixtures-Henderson's equation-Hydrolysis of salts-Degree of hydrolysis.						
Unit:2						
Unit:2		Conductivity of Ions			15hours	
Electrical conduction, conduction in metal and in electrolytic solutions. Measurement of conductivity in electrolytic solutions. Migration of ions-Kohlrausch's law. Arrhenius theory of electrolytic dissociation-Ostwald's dilution law. Theory of strong electrolytes-Debye-Huckel- Onsagar theory (elementary account only) verification. Debye-Falkenhagen effect-Wien effect-Transport numbers-Determination. Conductometric titrations.						

Unit:3	Electrochemical Cells	15hours
Electro chemical cells. Electrode potentials- The standard hydrogen electrode kinds of electrodes and their potentials-Nernst equation. EMF- computation and measurement of cell EMF. Single Electrode potential – Determination and significance of electrode potentials -electrochemical series- temperature dependence of the cell EMF- Thermodynamic quantities of cell reactions.		
Unit:4	Electrode Potential	15hours
Reference electrodes-Electrodes for measurement of pH- concentration cells with and without transport-liquid junction potential- applications of EMF measurements. Redox potential- Redox indicators-uses. Potentiometric titrations.		
Unit:5	Fuel and Storage Cells	15hours
Fuel cells: Hydrogen- oxygen cell and hydrocarbon - oxygen cell. Storage cells. Lead storage cell and Nickel cadmium cell. Decomposition voltage-over voltage-Deposition and discharge potential.		
	Total Lecture hours	75hours
Text Book(s)		
1	B. R. Puri and L. R. Sharma, Principles of physical chemistry, Shoban Lal Nagin Chand and Co. 33rd edition, 1992.	
2	S. H. Maron and J. B. Lando, Fundamentals of physical chemistry, Macmillan limited, New York, 1966.	
Reference Books		
1	S. K. Dogra and S. Dogra, Physical chemistry through problems, new age international, 4th edition 1996.	
2	P. W. Atkins, Physical chemistry, Oxford university press, 1978	
3	K. L. Kapoor, A textbook of Physical chemistry, (volume-2 and 3) Macmillan, India Ltd, 1994.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://chem.pg.edu.pl/documents/175289/4235721/Electrochemistry-supplement%20text.pdf	
2	https://nptel.ac.in/courses/104/106/104106105/	
3	https://nptel.ac.in/content/storage2/courses/103108100/module6/module6.pdf	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	S	S	M	M
CO2	M	S	M	S	S	L	M
CO3	M	M	S	M	S	S	M
CO4	S	S	M	M	M	S	S
CO5	S	L	S	M	M	M	M

*S-Strong; M-Medium; L-Low

Course code	53D	ANALYTICAL CHEMISTRY	L	T	P	C
CORE		Core XI–Paper IX	4	-	-	4
Pre-requisite		Higher Secondary Level	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Understand the principles of various analytical techniques and their applications						
2. Analyze errors and perform various tests for analytical data						
3. Outline the concepts of gravimetric methods in quantitative analysis						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the principles of various analytical techniques and their applications				K2, K3	
2	Evaluate different types of errors and correct them.				K1, K5	
3	Perform various tests for set of analytical data				K3, K4	
4	Understand the theory of quantitative analysis				K1, K6	
5	Determine an analyte quantitatively using gravimetric methods				K3, K5	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Analytical Techniques		12hours				
Basic principles and applications of Analytical techniques such as Precipitation, filtration, sample drying, transfer of precipitates, distillation, vacuum distillation, fractional distillation and steam distillation. Sublimation, crystallization, fractional crystallization and Refractive Indices.						
Unit:2						
Data Analysis		12hours				
Evaluation of Analytical data: Accuracy and precision, methods for their expression, classification of errors, detection and correction of determinate and indeterminate errors. The normal law of Distribution of Indeterminate errors.						
Unit:3						
Statistical Tests and Significant Figures		12hours				
The F test and the T test, rejection of data-the method of least squares, propagation of errors in computation-significant figures.						
Unit:4						
Quantitative Analysis and Chemical Equilibrium		12hours				
Theory of Quantitative Analysis; Application of Chemical equilibrium to analytical separations and estimations: The equilibrium constants, activity coefficients. Acid- Base equilibria, solubility equilibria, distribution equilibria, Complex ion equilibria and stability constant Separations and estimations: illustrated with examples.						
Unit:5						
Gravimetric Methods		12hours				
Theory of indicators, Theory of precipitation, Co-precipitation, post-precipitation, theory of purifying the precipitates, Acid-Base, redox, Complexometric and precipitation Titrations, Volumetric analysis.						
Total Lecture hours			60hours			

Text Book(s)	
1	Elements of Analytical Chemistry. R. Gopalan, Sultan Chand & Sons
Reference Books	
1	Quantitative Chemical Analysis, A. I. Vogel.
2	Instrumental Methods of Analysis, Skoog.
3	Instrumental Methods of Analysis, Willard, Dean, Merritt and Settle, CBS.
4	Vogel's Textbook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, RC Denney, Fifth Edition, Bath Press, Great Britain, 1989
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.mobt3ath.com/uploade/book/book-19965.pdf
2	https://chem.libretexts.org/Courses/University_of_California_Davis/UCD_Chem_105/Chapters/5.Errors_in_chemical_analysis
Course Designed By: Dr. S. Karthikeyan	

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	L	S	S	S	M
CO2	S	M	M	S	S	M	S
CO3	M	M	S	S	S	M	S
CO4	S	S	S	M	S	M	S
CO5	S	M	L	M	S	S	S

Course code	5ZC	WATER & EFFLUENT TREATMENT AND POLLUTION CONTROL	L	T	P	C
SBS		Skilled Based Subject– III	2	-	-	3
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Over view of impact of man on the environment						
2. Detail view of pollutions and water softening techniques						
3. Description about water effluent treatment and pollution analysis techniques						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To understand urbanization and biodiversity along with environmental pollution.					K1, K2
2	Acquires the knowledge about water pollution and water softening methods.					K1, K2, K3, K4
3	Importance about water analysing methods along with determination of BOD, COD and toxicity.					K2, K3, K4,
4	Detail explanation of primary, secondary and tertiary water treatment methods.					K2, K3, K4, K5
5	Discuss about effect of noise pollution along with brief study on modern methods for pollution analysis.					K1, K2, K4
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Sources of Pollution				6hours
Impact of man on the Environment—an overview of Urbanization and Biodiversity. Environmental pollution – classification of pollution – Effect of industrial effluents – a detailed study of effluents discharged by Soap and detergent manufacture industry and Textile processing industry (study includes origin of effluent, important characteristic and general mode of treatment). Constituents of water and their effect on Textile wet processing–Water pollution– Harmful effects of water pollution and source of water pollution.						
Unit:2						
Unit:2		Water Pollution and Softening Methods				6hours
WHO, ISO standards for raw water criteria – A general study on raw water pollution and consequence of river water pollution – Effluent discharge standards for inland surface water public sewers, on land for irrigation, marine coastal areas and drinking water parameters- A general study on boiler water requirements which includes problem caused by water and effect and feed water requirements for low and medium pressure boilers and at a pressure of 450 – 500psi. Water softening – study includes Cation Exchange softening, lime soda softening, softening by Sequestering agents and De-mineralization with schematic diagram of removal of carbon dioxide and silica.						

Unit:3	Analysis Techniques for Water	6hours
Removal of colour and turbidity (simple Coagulation, Flocculation and Filtration methods). General study on removal of Iron and Manganese by Aeration, setting and filtration method- Water analysis – colour, pH value, dissolved solids, suspended solids, total hardness (Calcium + Magnesium). EDTA Titrimetric method, total iron- thiocyanate method, Determination of Alkalinity by Titrimetric method–thiocyanate method, Determination of Alkalinity by Titrimetric method- Determination of chlorides by silver nitrate method- Determination of dissolved oxygen by iodimetry–Determination of BOD, COD TDS and Toxicity.		
Unit:4	Water Treatment Methods	6hours
Effect of effluents–General treatment procedure parameters to be determined at Sizing, Desizing, Kier boiling, Bleaching, Mercerizing, Dyeing, Printing, combined effluent treatment of industrial wastes- Brief study on Screening, Sedimentation, Equalization, Neutralization, Coagulation, Secondary treatment– Trickling filtration Activated sludge process, oxidation ponds, Anaerobic Digestion, Tertiary treatment- Evaporation (solar & steam). Reverse osmosis, ion exchange, chemical precipitation and removal by Algae and activated carbon treatment.		
Unit:5	Analysis Techniques for Pollution	6hours
Model schematic diagram for waste water treatment plant for textile mills-Primary & secondary units –Effects of air pollution –Effects of Sulphur oxide on human health – Ambient air quality standards- Noise pollution –ill effects of noise-Noise level in decibels. Brief study on modern methods for pollution analysis like molecular luminescence, BOD incubator, ionexchange chromatography and HPLC.		
	Total Lecture hours	30hours
Reference Book(s)		
1	Environment Pollution control Engineering by C. S. Rao. New age International Ltd & Publishers.	
2	Industrial safety & Pollution control Hand Book by National safety council and Associate Data Publisher Pvt Ltd.	
3	Industrial Effluents by N. Mani vasakam, Sakthi Publications, Coimbatore.	
4	Water used in Textile Processing by N. Mani vaskam, Sakthi Publications, Coimbatore.	
5	Tamil nadu state publications and H and book of pollution control–Central Board of pollution control.	
6	Textile Effluents by Padma Varkar, NCUTE Publications, IIT, Delhi.	
7	Environmental Chemistry and pollution Control, S. S. Dhara, S. Chand &Co., Delhi.	
8	Pollution in Textile Industry, K. B. Krishna kumar, SSMITT Students Cooperative Stores, Komarapalayam.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/105/104/105104102/	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	S	S
CO2	M	S	M	S	S	S	M
CO3	S	M	S	S	S	M	M
CO4	S	M	S	S	M	S	S
CO5	S	S	M	S	S	S	S

*S-Strong; M-Medium; L-Low





Sixth Semester

Course code	63A	ORGANIC CHEMISTRY-II	L	T	P	C
CORE		COREXII -PAPER X	5	6	-	4
Pre-requisite		Knowledge on basic structure and reactions of simple organic compounds.	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Understand the optical activity of various molecules and their naming patterns.						
2. Study the mechanism of different rearrangement reactions.						
3. Acquire the knowledge on reactions and structures of heterocyclic compounds, amines and proteins.						
4. Predict the structure of natural products like vitamins, alkaloids, terpenoids and harmones.						
Expected Course Outcomes:						
On the successful completion of the course, students will be able to:						
CO1	Gain the knowledge on different types of optically active molecules and their naming methods.					K2, K4, K5
CO2	Understand the mechanisms of inter and intra molecular rearrangement reactions with examples.					K2, K4
CO3	Acquire the knowledge on the preparation, properties and uses of heterocyclic compounds, amino acids and proteins.					K2, K3
CO4	Know the classification, structural elucidation and synthesis of terpenoids and vitamins.					K2, K4, K5
CO5	Understand the different types and structural elucidation of alkaloids and harmones.					K2, K4, K5
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	Stereochemistry					15 hours
Optical activity – Asymmetric carbon – Racemization – Resolution – Asymmetric synthesis – D, L and R, S notation. Optical activity due to restricted rotation in biphenyls, allenes and spiranes– Molecular overcrowding.						
Unit:2	Molecular Rearrangements					15 hours
Mechanism of Pinacol – Pinacolone rearrangement – Beckmann rearrangement – Hoffmann rearrangement–Curtius rearrangement–Benzilic acid rearrangement– Schmidt rearrangement–Lossen rearrangement –Cope rearrangement and Claisen rearrangement.						
Unit:3	Heterocyclic Compounds and Proteins					15 hours
Heterocyclic Compounds: Chemistry of Furan, Pyrrole, Thiophene, Pyridine – Synthesis and uses of Quinoline, Isoquinoline and Indole.						
Proteins: Amino acids – Classification – Peptide linkage – Proteins – Classification based On physical properties and biological functions – Primary, Secondary and Tertiary structure – Uses.						

Unit:4	Terpenoids and Vitamins	15 hours
Terpenoids: Introduction–Classification–General methods of isolation– Isoprene rule- structural elucidation and synthesis of Geraniol, Terpeneol and Dipentene. Vitamins: Introduction–Importance of vitamins– Structural elucidation and synthesis of Retinol, Riboflavin and Ascorbic acid.		
Unit:5	Alkaloids and Hormones	15 hours
Alkaloids: Introduction – Classification and General Characteristics – General methods of determining structures–Hoffmann’s exhaustive methylation– Structural elucidation and synthesis of Nicotine, Piperine and Papaverin. Hormones: Introduction–Structural elucidation and synthesis of Adrenaline and Thyroxine.		
	Total Lecture hours	75 hours
Text Book(s)		
1	Advanced Organic Chemistry –B. S. Bahland Arun Bahl, S. Chand &Co., 2012.	
2	Organic Chemistry, R. T. Morrison and R. N. Boyd, Pearson Education, Sixth Edn., 2002.	
3	Textbook Organic Chemistry, P. L. Soni, S. M. Chawla, Sultan Chand & Sons, 2007.	
Reference Books		
1	Organic Chemistry–Vol. 1 and Vol. 2, I. L Finar, Pearson Education, Sixth Edn., 2006.	
2	Stereochemistry of Organic compounds, D. Nasipuri, New Age International(P)Ltd, Second Edn., 2005.	
3	Stereochemistry: Conformation And Mechanism-P. S. Kalsi, New Age International Private Ltd., 2015	
Online References (Go to the following websites and search with the specific topics/ keywords)		
1	https://ndl.iitkgp.ac.in/	
2	https://nptel.ac.in/course.html	
3	https://ocw.mit.edu/	
4	https://www.oercommons.org/advanced-search	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	S	M	S	M
CO2	L	M	M	S	L	S	S
CO3	S	S	M	M	M	S	S
CO4	S	M	S	S	M	S	S
CO5	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	63B	PHYSICAL CHEMISTRYII	L	T	P	C
CORE		Core XIII– Paper XI	5	5	-	4
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2025-2026	
Course Objectives:-						
The main objectives of this course are to: 1. Impart knowledge on electrical and magnetic properties of molecules 2. Describe the order and molecularity of reaction and determination of order of reactions 3. Broad description of theoretical aspects and experimental techniques of kinetics of different types of reactions.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the electrical properties of molecules and its application					K1-K3
2	Understand magnetic properties of molecules and its application for solving problem for structure determination					K1-K3
3	Know about the order and molecularity of reaction and also determination of order of reactions					K2-K4
4	Understand and learn the theoretical and experimental aspects of kinetics of reactions					K1-K4
5	Gain detailed knowledge on photochemical and thermal reactions.					K1-K3
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6–Create						
Unit:1						
Unit:1		Electrical Properties of Molecules			15 hours	
Electrical properties of molecules: Molar polarization, Orientation polarization and Distortion polarization polar and non-polar molecules. Determination of dipole moment of polargases, liquids and solids-Application of dipole moment in the study of simple molecules.						
Unit:2						
Unit:2		Magnetic Properties of Molecules			15 hours	
Magnetic properties of molecules; Meaning of the term's magnetic susceptibility, magnetic moment, diamagnetism, paramagnetism and ferromagnetism, Determination of magnetic susceptibility by Guoy's method. Application of magnetic properties in solving structural problems.						
Unit:3						
Unit:3		Order and Molecularity of Reactions			15 hours	
Empirical laws and experimental aspects. Rate laws, Stoichiometry, order and molecularity of reactions- Setting up and solving simple differential equation for first order, second order, third order and zero order reactions. Characteristics of I, II, III I and Zero order reactions. Determination of order of reactions.						

Unit:4	Kinetics of Reaction	15 hours
Experimental techniques involved in following kinetics of reaction. Volumetry, manometry, polarimetry and colorimetry, typical examples for each of the techniques. Theoretical aspects. Effect of temperature on rate constant. The activation energy. The collision theory of reaction rates and its limitation. Lindemann theory of unimolecular reactions. The theory of Absolute reaction rates. Comparison of the collision theory with the Absolute reaction rate theory.		
Unit:5	Photochemical Reactions	15 hours
Thermal chain reaction H ₂ /Br ₂ reaction. Kinetics of photo chemical reactions. Absorption of light and photochemical process. The Stark- Einstein law of photochemical equivalence. Photochemical chain reaction H ₂ /Br ₂ reaction. Quantum yield of photochemical reactions. Comparison of thermal & photochemical kinetics of H ₂ /Br ₂ reaction. Photo sensitized reactions. Fluorescence, phosphorescence and chemiluminescence.		
	Total Lecture hours	75 hours
Text Book(s)		
1	Principles of Physical Chemistry, B. R. Puri, L. R. Sharma and M. S. Phathania, Shobanlal Nagin Chand &Co	
2	Essentials of Physical Chemistry, B. S. bahland G. D. Tuli, S. Chand &Co	
3	Text book of physical Chemistry, P. L. Soni, Dharmarke; Sultan Chand &Son	
Reference Books		
1	Physical Chemistry, P. W. Atkins, Oxford	
2	Physical Chemistry, R. A. Alberty, John. Wiley &Sons	
3	Elements of physical Chemistry, S. Glass tone and D. Lewis, McMillan	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://archive.org/details/2015.135344.ElementsOfPhysicalChemistryEd2nd/page/n9/mod/e/2up	
2	https://nptel.ac.in/content/storage2/courses/122101001/downloads/lec-26._pdf	
3	https://www.youtube.com/watch?v=W8FhIGNnMkg&t=5447s	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	M	S	S
CO2	M	S	S	M	S	S	S
CO3	S	M	S	L	S	M	M
CO4	S	S	L	S	M	S	S
CO5	S	M	S	S	M	S	M

*S-Strong; M-Medium; L-Low

Course code	63P	GRAVIMETRIC ANALYSIS AND PHYSICAL CHEMISTRY	L	T	P	C
CORE PRACTICAL		COREXIV-CHEMISTRY PRACTICAL III	-	-	5	4
Pre-requisite		Basics Knowledge on Analytical and Physical Chemistry	Syllabus Version		2025-2030	
Course Objectives:						
The main objectives of this course are to:						
1. Make the students to learn a technique to determine the amount of an analyte (cation) through the measurement of mass.						
2. Impart understanding about conductance of a solution by the addition or removal of ions.						
3. Realize and explore the fundamentals of basic physical chemistry experiments, including chemical kinetics, phase diagram and molecular weight determinations.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concept of gravimetric analysis.					K1-K6
2	Find a suitable precipitation method and perform effective precipitation to determine the amount of the cation.					K1-K6
3	Calculate the conductance of the solution at various stages of neutralization					K2-K5
4	Determine the rate and dissociate constant for a reaction					K2-K4
5	Perform graphical analysis to arrive experimental results based on the physical chemistry experiments.					K1-K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Part I	Sintered Crucible Based Gravimetric Analysis					30hours
1. Estimation of Barium as Barium Chromate.						
2. Estimation of Lead as Lead Chromate.						
3. Estimation of Nickel as Nickel Dimethyl Glyoxime.						
Part II	Silica Crucible Based Gravimetric Analysis					30hours
1. Estimation of Sulphate as Barium Sulphate						
2. Estimation of Calcium as Calcium Oxalate.						
Part III	Conductometric Physical Experiments					30hours
1. Conductometric titrations, strong acid-strong base.						
2. Conductometric titrations, Weak acid-strong base.						
3. Determination of cell constant, specific conductivity and equivalent conductivity of strong electrolyte.						
Part IV	Physical Organic Experiments					30hours
1. Determination of rate constant of acid-catalyzed hydrolysis of an ester (Methyl acetate or Ethyl acetate).						
2. Determination of dissociation constant of a weak acid (acetic acid).						

PartV	Temperature Based Physical Experiments	30hours
1. Determination of K _f / molecular weight by Rast's macro method -Naphthalene, Diphenyl and diphenylamine		
2. Determination of critical solution temperature of Phenol-Water system.		
3. Effect of impurity (NaCl, /succinic acid) on CST.		
4. Phase Diagram –Simple Eutectic system.		
5. Determination of the transition temperature		
Total Practical hours		150hours
Text Book(s)		
1	Basic Principles of Practical Chemistry, Kulandaivelu A. R., Veeraswamy R., Venkateswaran, Sultan Chand & Sons, 2017.	
2	Practical Chemistry for B. Sc Chemistry, A. O. Thomas	
Reference Books		
1	Vogel's Textbook of Quantitative Chemical Analysis, GH Jeffery, J Bassett, J Mendham, RC Denney, Fifth Edition, Bath Press, Great Britan, 1989	
2	Advanced Practical Physical Chemistry, Yadav J. B., Goel Publishing House, 2014.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.youtube.com/watch?v=6Kd0qIczD24	
2	https://www.youtube.com/watch?v=peMyqdJ57dA (EstimationofNickel)	
3	https://www.youtube.com/watch?v=-GS6uoFf3qQ (strong-acid-strongbase)	
4	https://www.youtube.com/watch?v=Dc4aUdADqY8 (weekacid-strongbase)	
5	https://www.youtube.com/watch?v=xo1wNSZpE4w (KineticsofEsterHydrolysis)	
6	https://www.youtube.com/watch?v=5oVnpYhmMVU (CSTofPhenol-WaterSystem)	
7	https://www.youtube.com/watch?v=2VzEpsEZOYo (Rast'sMacroMethod)	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	M	S	S	S	M	S	M
CO4	M	S	M	S	M	M	M
CO5	M	S	M	S	S	M	M

*S-Strong; M-Medium; L-Low

Course code	63Q	PRACTICALFORELECTIVE SUBJECTS	L	T	P	C
COREPRACTICAL		COREXV	-	-	3	4
Pre-requisite		Basics Knowledge on Organic, Inorganic and Physical Chemistry	Syllabus Version		2025- 2026	
Course Objectives:						
The main objectives of this course are to:						
1. Impart skills in the student to analyse a substance by finding their physical constants.						
2. Impartknowledgetopreparevariousorganometallicandorganicsubstancesusingcomplexation, oxidation, reduction, hydrolysis and other techniques.						
3. MakethestudentslearnthetechniqueofestimationofasubstanceusingComplexometricitrations.						
4. Inculcate the knowledge and skills in the estimation of a substance using colour and light						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Use the physical constants in the analysis of a substance.					K1-K5
2	Prepare inorganic complexes					K1-K6
3	Perform organic transformation involving substitution and oxidation reactions					K1-K5
4	Use effectively the Complexometric method to estimate hardness of water					K2-K6
5	Colorimetric methods in the estimation of various salts and ions.					K1-K5
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Part I		Determination of Melting and Boiling Point			3hours	
1. Determination of Melting point/ Boiling point of an organic substance.						
Part II		Preparation of Inorganic Complexes			18hours	
(a) Tetramminecopper (II)sulphate						
(b) Potassium Trioxalatochromate (III)						
(c) Prussian Blue						
(d) Hexammine Cobalt (II) chloride						
(e) Potassium TrioxalatoFerrate (III)						
(f) Sodium Cuprous Thiosulphate.						
Part III		Organic Preparation			12hours	
Preparation involving, Hydrolysis, Oxidation, Halogenation, Nitration and Benzoylation.						
Part IV		Estimation Using EDTA Method			3hours	
Estimation of Hardness of Water using EDTA.						
Part V		Estimation Using Calorimetric Method			9hours	
Calorimetric experiments involving Nessler's tubes.						
(a) Estimation of Fe ³⁺ with Ammonium thiocyanate.						
(b) Estimation of Ni as Nickel Dimethyl glyoxime.						
(c) Estimation of Mn ²⁺ in Potassium permanganate						
					Total Practical hours	
					45hours	

Text Book(s)	
1	Basic Principles of Practical Chemistry, Kulandaivelu A. R., Veeraswamy R., Venkateswaran, Sultan Chand & Sons, 2017.
2	Practical Chemistry, Pandey D. N., Sultan Chand Publishers, 2018
Reference Book	
1	Vogel's Textbook of Quantitative Chemical Analysis, GH Jeffery, J Bassett, J Mendham, RCDenney, Fifth Edition, Bath Press, Great Britain, 1989
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/104/101/104101006/
2	https://nptel.ac.in/content/storage2/courses/104105033/Questions%20Answers%20Coordination.pdf
3	https://www.youtube.com/watch?v=EQxvY6a42Dw
4	https://www.youtube.com/watch?v=noUSORH5JWo
5	https://en.wikipedia.org/wiki/Colorimetric_analysis
Course Designed By: Dr. S. Karthikeyan	

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	M	S
CO2	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S
CO4	S	S	S	S	S	M	S
CO5	S	S	S	S	S	S	S



Skill Based Subject

Course code	6ZP	TEXTILECHEMISTRYPRACTICAL	L	T	P	C
SKILLBASEDSUBJECT	TEXTILECHEMISTRYPAPER– IV		-	-	2	3
Pre-requisite	Knowledge of Higher Secondary Level and Dye Chemistry		Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Impart skills and knowledge to the students in handling laboratory equipment and reagents						
2. MakethestudentslearnthetechniqueintheanalysisofwaterqualityusingpHandvolumetrictechniques for industrial use.						
3. Impart skills in the estimation of various industrial substances						
4. Impart knowledge in the preparation of various industrial dyes and dyeing.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Analyze the quality of water for industrial use as well as various substances of industrial use				K1-K6	
2	Learn the various methods of dye preparation and dyeing.				K1-K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Part I	Analysis				15hours	
1. Estimation of pH-paper, digital pH meter, pH solution						
2. Volumetric analysis of Sodium Nitrite						
3. Estimation of available chlorine in bleaching powder						
4. Analysis of acidity of water by Volumetry						
5. Analysis of alkalinity of water by Volumetry						
Part II	Preparation of Dyes				15hours	
1. Methyl Red						
2. Malachite Green						
3. Methyl Orange						
4. Para nitrobenzene azobetanaphthol						
5. Azoamino benzene.						
	Total Practical hours				30hours	
Text Book(s)						
1	Elementary Idea of Textile Dyeing, Printing and Finishing” Kanwar Varinder Pal Singh, Kalyani Publishers, 2009					
2	Instrumental Methods of chemical Analysis, B. K Sharma, 2014					
3	The Complete Technology Book on Dyes & Dye Intermediates by National Institute of Industrial Research, 2004					
Reference Books						
1	Handbook of Water Analysis, 3 rd Edition by Nollet, Taylor and Francis, 2013.					
2	Vogel's text book of quantitative Chemical Analysis, Sixth edition-J Mendham, RC Denney, J D Barnes, MJK Thomas, Pearson Education Publishers, 2009.					

Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/content/storage2/courses/105101010/downloads/Lecture27.pdf
2	https://en.wikipedia.org/wiki/Analysis_of_water_chemistry
3	https://www.youtube.com/watch?v=cNiRWfMjQMU
4	https://nptel.ac.in/courses/103/107/103107081/
5	https://study.com/academy/lesson/chemicals-dyes-used-in-the-textile-industry.html
Course Designed By: Dr. S. Karthikeyan	

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S





Elective Courses

Course code	5EA	POLYMERCHEMISTRY	L	T	P	C
ELECTIVE		Elective–I(A)	4	-	-	3
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. To understand the types, nature and the various methods of preparation polymers.						
2. To learn about the different types of polymerisation reaction mechanism, bonding and proper ties of polymers.						
3. To study the molecular weight determination methods, preparation and properties of commercially important polymers.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Classify Polymers based on their origin, mechanism of formation, citing example. Understand the methods of preparation process and apply the- correct method of preparation for a particular polymer.					K1-K3
2	Analyze the reaction mechanisms of polymerization.					K1, K4
3	Understand the relation between the bond forces and structural properties of polymers.					K2, K4
4	Understand the principles behind the molecular determination methods and applying them to calculate the different molecular weights of polymers.					K2, K4
5	Explain the basic preparation methods and have a good knowledge on the Industrial Applications of Polymers.					K2, K3
K1-Remember; K2-Understand; K3- Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Classification and Preparation of Polymers			12hours	
1. Classification Of Polymers-Natural Polymers and Synthetic Polymers. Synthetic Polymers- Addition Polymers, Condensation Polymers.						
2. Methods Of Preparation of Polymers-Bulk, Solution, Suspension and Emulsion						
Unit:2						
Unit:2		Types of Polymerizations			12hours	
Different Types of Polymerization-Step Growth Polymerization, Addition Polymerization and Co-Polymerization-Random, Alternate, Block and Graft Polymerization.						
Unit:3						
Unit:3		Properties of Polymers			12hours	
Primary And Secondary Bond Forces in Polymers-Coherence Energy-Structure Property Relationship i) Mechanical Properties ii) Thermal Stability- Glass Transition Temperature iii) Flame Resistance iv) Chemical Resistance v) Degradability vi) Electrical Conductivity						

Unit:4	Determination of Molecular Weight Methods	12hours
Molecular Weight of Polymers- Number Average and Weight Average Molecular Weight Methods Number Average Molecular Weight Methods 1. Osmometry (membrane) 2. Cryoscopy & Ebullioscopy 3. Osmometry (vapor pressure) 4. Viscometry 5. End Group Analysis. Weight Average Molecular Weight Methods. 1. Light scattering 2. Ultracentrifugation Molecular weight distribution.		
Unit:5	Industrial Polymers	12hours
Important industrial polymers, preparation and applications of i) Polyethylene, polypropylene ii) Polyamides iii) Polyvinylchloride and poly methyl meth acrylate iv) Polyesters and polycarbonates v) Polyurethanes vi) Phenol-formaldehyde and melamine-formaldehyde vii) Polysilanes and polysiloxanes viii) Polyaniline		
	Total Lecture hours	60hours
Text Book(s)		
1	Polymer Science- VR Gowariker; NV Viswanathan; Jayadev Sreedhar- New Age International-2003	
Reference Books		
1	Polymer chemistry an introduction -M. P. Stevens, Oxford-1990	
2	Textbook of polymer Science- FW Billmeyer, Wiley-1984.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://youtu.be/k_REdKwaAg	
2	https://youtu.be/HIY1oxQ5eUA	
3	https://youtu.be/7AWQyFr_GLA	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	L	S	S	S	M
CO2	S	M	M	S	S	M	S
CO3	M	M	S	S	S	M	S
CO4	S	S	S	M	S	M	S
CO5	S	M	L	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code		AGROINDUSTRIALCHEMISTRY	L	T	P	C
ELECTIVE		Elective I(B)	4	-	-	3
Pre-requisite		Basic Knowledge in Agriculture	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Let students know the sources of water for agriculture. Impart the knowledge of water and soil analysis.						
2. Inculcate the students about available fertilizers and pesticides and their role						
3. To describe the various stages of process in sugar production and starch fermentation.						
4. Knowledge on oil, fats and waxes and their contribution to day-to-day life.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Have knowledge on the sources of water for agriculture and analysis of water and basics on waste water treatment					K2-K4
2	Acquires the knowledge abouts oil, soil fertility and various parameters involved in evaluation of soil.					K1-K5
3	Describe the importance of nutrients, fertilizers and pesticides for plant growth					K2-K4
4	Understand the sources and production of sugar and uses of molasses.					K1-K6
5	Outline the chemistry of oils, fats and waxes and their role in everyday life					K2-K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	Water source for agriculture-Water Treatment& Analysis					12hours
Sources of water supply for agriculture. Hard and soft water. Water softening methods: lime soda process, phosphate conditioning, permutit and ion-exchange processes. Water analysis; determination of hardness of water, acidity, alkalinity, pH value, amount of free CO ₂ , Fluoride content, chloride content and their estimation. Biological oxygen demand (BOD), chemical oxygen demand (COD), chlorine demand and their determinations. Recycling of water.						
Unit:2	Chemistry of soil- soil classification and soil analysis					12hours
Definition of soils. Classification of soils. Properties of soils-physical properties and mechanical analysis. Structure and texture. Soil water, soils air and soil temperature. Chemical properties-soil mineral matter-soil colloids, ion-exchange reactions. Soil fertility and its evaluation. Soil organic matter and their influence on soil properties –N ratio effects. Soil reactions. Soil pH, acidity, alkalinity, buffering of soils and its effects on the availability of N, P, K, Ca, Mg, I, Al, Mn & sulphuric acid. soils salinity, acid & alkaline soils – their formation and reclamation.						
Unit:3	Fertilizers and Pesticides					12hours
Fertilizers: 1. Effect of N, P, K, secondary nutrients and micronutrients on plant growth and development.						
2. Importance of nitrogenous fertilizers. Nitrogen cycle and fixation of atmospheric nitrogen. Principle and manufacture of ammonium nitrate, ammonium sulphate, and urea						

3. Phosphate fertilizers. Preparation and uses of mono and diammonium phosphates, super phosphate and triple super phosphate.		
4. Potassium fertilizers-potassium nitrate, potassium chloride, potassium sulphate. Mixed fertilizers. Methods of compost in green manuring, concentrated organic manures and their chemical composition. Oil cakes, horn and hoof meal.		
Pesticides Classification-Insecticides, fungicides and herbicides. General methods of preparation, application and toxicity. Insect attractants and repellants-fluorine compounds, boron compounds, arsenic compounds, organomercuric compounds, DDT, BHC, 2, 4 -D compounds, pyridine compounds.		
Unit:4	Chemistry of sugar and fermentation	12hours
1. Details of manufacture of sucrose from cane sugar – extraction of juice, purification, concentration, crystallization, separation and refining of crystals, recovery of sucrose from molasses. Manufacture of sucrose from beetroot. Estimation of sucrose and inversion sugar by polarimetry. 2.Manufacture of alcohol from molasses and starch by fermentation process.		
Unit:5	OILS, fats and Waxes	12hours
Classification of oils fats and waxes: distinction between oil, fats and waxes Hydrogenation of oils-principle and manufacturing details. Definition and determination of saponification value, acid value, iodine value RM value and Hehner value and their signification. Elaidin test for oils. Some common waxes like spermaceti, Beeswax, bayberrywax and their uses. Soapandits manufacture; toilet and transparent soaps. Cleansing action of soap. Detergent.		
	Total Lecture hours	60hours
Text Book(s)		
1	Soil Chemistry– Shivan and Tolanur, CBS Publishers & Distributors2 nd Edition, 2018.	
	Insecticides, Pesticides and Agro based Industries–R. C. Palful, K. Goel, R. K. Gupta	
2	Industrial Chemistry-B. N Chakrabarty, Oxford & IBH Publishing Co, New Delhi, 1981	
3	Industrial Chemistry-B. K. Sharma, GOEL Publishing House, 2000	
Reference Book		
1	Nature and properties of soils - NyleC. Brandy, Ray R. Weil, Pearson Education India; 14 th Edition, 2013.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.cdc.gov/healthywater/other/agricultural/index.html	
2	http://nmsp.cals.cornell.edu/publications/NMSPLabManual2017.pdf	
3	https://www.youtube.com/watch?v=R9J7pOU5FSg	
4	https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/2017/Oils-Fats-Waxes- Notes. pdf	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	M	S
CO2	S	M	M	S	S	S	S
CO3	S	M	S	M	S	S	S
CO4	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		PHARMACEUTICAL CHEMISTRY	L	T	P	C
ELECTIVE		Elective I(C)	4	-	-	3
Pre-requisite		Basic Knowledge in Chemistry and Biology	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Give an overview on pharmaceutical chemistry and terminologies used in.						
2. Outline the structure and properties of molecules in biological systems						
3. Impart knowledge about medicinally important compounds						
4. Describe the role of various drugs in cardiovascular						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Have knowledge on terminologies used in pharmaceuticals and their clinical chemistry					K1, K2
2	Understand the chemistry and uses of alkaloids, analgesics, antibiotics and sulfonamides					K1, K2, K3, K4
3	Understand how molecules play important role as medicine					K2, K3, K4,
4	Have knowledge on bioinorganic chemistry and their role in various diseases					K2, K3, K4, K5
5	Outline the importance of drugs with special emphasize on cardio vascular related diseases					K1, K2, K4
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Introduction to Pharmaceutical Chemistry				12hours
1. Important terminologies used in pharmaceutical chemistry-Definition of the following terms- drug, pharmacology, pharmacognosy, pharmacy, therapeutics, toxicology, chemotherapy, pharmacopoeia (BP, IP, USP), National formulary, pharmacophore, bacteria, virus, vaccines, toxoids, primary immunization, additive effect, synergism, antagonism, placebo, LD50, ED50 and the therapeutic index						
2. Routes of drug administration-local, enema, oral or external, parental- advantages and disadvantages oral and parental routes- inhalation, intradermal, subcutaneous, intramuscular, intravenous-intrathecal-intraarticular- transcutaneous-transmucosal.						
3. Clinical chemistry-A Diagnostic test and one method of estimation bilirubin and cholesterol in serum or plasma or urine. Biuret test for urea.						
4. First aid to prevent bleeding and maintain breathing						
5. Causes and symptoms of food poisoning, botulism- mushroom and plant poisoning- first aid.						
6. Causes, symptoms and treatment of anemia, diabetes, tuberculosis, asthma, jaundice, piles, leprosy, typhoid, malaria, cholera and filarial.						
7. Indian medicinal plants and their importance. Spices and their medicinal uses.						

Unit:2	Alkaloids, Analgesics, Antibiotics and Sulfonamides	12hours
<p>1. Alkaloids-definition-general methodsof isolation-colour testsfor identification-source, isolation, structure and use of atropine-source, extraction, structure, SAR and uses of morphine and quinine.</p> <p>2. Analgesics-definition different types of pain (superficial, deep non visceral, visceral, referred and pshycogeneic), classification – morphine and its derivatives. Synthesis assay and uses of pethidine and methadone-antipyretic analgesics-salicylic acid derivatives- paracetamol, phenacetin-propanoic acid derivative-Ibuprofen.</p> <p>3. Antibiotics: definition –microbial synthesis structure, assay and uses of chloramphenicol and penicillin- structure and use of streptomycin and tetracyclines.</p> <p>4. Sulphanon amides: Definition-mechanism of action-classification-SAR- synthesis and use of sulpha acetamide, sulphanthiazole, phthalylsulphathiazole- sulphadiazine and sulpha pyridine- assay.</p>		
Unit:3	Molecules to Medicine	12hours
<p>1. Antiseptics and disinfectants: Definition and distinction-phenol coefficient-examples-phenolic compounds, dyes, cationic surfactants and chloro compounds. Tranquilizers-definition and examples. Psycho delict drugs LSD and marijuana.</p> <p>2. Anesthetics –Definition–Classification– volatile anaesthetics (N_2O, ethers, halo hydrocarbons, chloroform, halo ethane)-Ferguson principle– intra venous anesthetics- structure of thiopental sodium-local anesthetic cocaine-source and structure – preparation and uses of procaine orthocaine and benzocaine.</p> <p>3. Vitamins-Definition- classification, sources and deficiency diseases of vitamins A, B, C, D, E and K. Importance of vitamin A in vision (rhodopsin cycle).</p> <p>4. Definition of cancer and antineoplastic drugs-examples antimetabolite, natural substances hormones, alkylating agents, inorganic complexes and other compounds- definition of hypoglycemic drugs-types and cause for diabetics - Examples (Sulphonyl ureas and biguanides)</p>		
Unit:4	Medicinally Important Compounds	12hours
<p>1. Medicinally important compounds of AlP_2As, Hg and Fe. Uses of the following $MgSO_4 \cdot 7H_2O$, milk of magnesia, magnesium trisilicate- Aluminium hydroxide gel, dihydroxy aluminium amino acetate, Aluminium acetate and aluminium monostearate-paroxon- phosphorine, cyclo phosphosphomide- tricyclophos- preparation and use of thio tepa- sodium and copper cacodylates-preparation and uses of aromatic are sericals (carbosone, triparasomide, acetarsonide, neoarsphenamine, oxo phenaridine)- $HgCl_2$, HgI_2 and $Hg(CN)_2$ as disinfectants -importance of organic mercury compounds- structure and uses of thiomersal, netromersalmer bromine and mersalyl acid-Ferrous gluconate, $FeSO_4$, scale preparation (ferric ammonium acetate), ferrous fumarate, ferrous succinate and ferrous chlorinate.</p> <p>2. Organic pharmaceutical aids-Definition-agents for kidney function (amino hippuric acid)- liver function (sulphobrophthale in sodium, rose Bengal)-corneal ulcer detection (Fluorescein in sodium)- Blood volume determination (Evans Blue) pituitary function (metyrapone)-ointment bases- preservatives-antioxidants- sequestrants, colouring, sweetening, flavouring, emulsifying and stabilizing agents.</p> <p>3. AIDS- cause HIV-propagation -prevention and treatment.</p>		

Unit:5	Cardiovascular and related drugs	12hours
1. Blood-composition-grouping-Rh factor-buffers in blood-Functions of plasma proteins-clotting mechanism-blood pressure. 2. Coagulants and anticoagulants- definitions and examples. 3. Antianemic drugs (iron, vitamin B12, folic acid). 4. Cardiovascular drugs : definition and names of drugs for each of the following-antiarrhythmic drugs- antihypertensive drugs-antianginal agents-vasodilators-lipid lowering agents-sclerosing agents		
Total Lecture hours		60hours
Text Book(s)		
1	Pharmaceutical Chemistry by S. Lakshmi, Sultan Chand & Sons, 2nd ed (1998).	
2	Pharmacology and pharma therapeutics, Vol. 1&2, R. S. Satoskar and S. D. Bhandarkar 11thEd, Popular prakashan, Mumbai, 1989.	
3	Bentleys, Textbook of pharmaceutics, 8thEd. E. A. Raubins, 1992, All India traveler book sellers, Delhi.	
4	Medicinal Chemistry, A shutoshkar, New Age International, 1992.	
5	A text book of pharmaceutical chemistry, Jayashree ghosh, S. Chand, 1997.	
Reference Book(s)		
1	From molecules to medicines-J. L. Sussman, P. Spadon, Springer;2009 th edition.	
2	Organic medicinal and pharmaceutical chemistry-J. M. Beale, J. H. Block, Wolters Kluwer India Pvt. Ltd. ;12 th edition2010.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.youtube.com/watch?v=jN34FZJ_--U	
2	https://www.youtube.com/watch?v=Wn33DQhmLbg	
3	https://www.youtube.com/watch?v=9xSgezCMHnw	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	M	M	S	M	S
CO2	M	M	S	M	M	S	S
CO3	S	M	S	L	S	M	M
CO4	S	M	M	M	M	M	L
CO5	M	S	M	L	M	M	M

Course code	LEATHERCHEMISTRY		L	T	P	C
ELECTIVE	Elective II(A)		4	-	-	3
Pre-requisite	Higher Secondary Level Chemistry		Syllabus Version		2024-2025	
Course Objectives:						
The main objectives of this course are to:						
1. To understand the basics of skins, leather and their composition.						
2. Impart the principle involved in pre-tanning and structure and process of various tannings						
3. Inculcate the methods of curing hides and skins and process of dyeing leather						
4. Knowledge on the water pollution by tannery industry and it's effluent treatment						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the structure and composition of hides and skins and principle involved in pre-tanning					K1-K3
2	Have knowledge on various types of tanning and their physic-chemical properties					K2, K3
3	Inter pret the chemistry behind the chrome tanning process					K2-K4
4	Analyze the process involved incurring of hides and skin and their preservation					K1-K4
5	Have clear idea on sources of tannery effluents and their treatment					K2, K3
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Hides, Skins and Leather				12hours
1. Hides, Skins, Leather-An elementary knowledge of the structure and composition of hides and skins. Proteins and their characteristics, Anatomy and histology of protein constituents of leather (an elementary concept).						
2. Basic principle involved in pre-tanning such as soaking, liming, deliming, bating, pickling involved in pre-tanning such as soaking, liming, deliming, bating, pickling and depickling.						
Unit:2						
Unit:2		Types of Natural and Synthetic Tannings				12hours
1. Types of tanning-vegetable and mineral tanning, Different types of vegetable tanning-materials classification and chemistry of vegetable tanning. Factros and Physio- chemical principle involved in vegetable tanning, Fixation of vegetable tanning.						
2. Synthetic tannings-their classifications, general methods of manufacture and use.						
Unit:3						
Unit:3		Chemistry of Chrome Tanning				12hours
1. The preparation and chemistry of chrome tanning liquids, Olation, Oxolation and hydrolysis of chrome liquids. Effect of adding tanning agents-Role of pH in the reaction of chromium complexes with hide proteins. Factors governing chrome tanning-chemistry of neutralization process. A brief survey of chemistry of other tanning like Al, Zrand Tesalts and their relative merit in contrast with chrome tanning						
2. Chemistry of combination of tannages involving vegetable tanning aldehydes, chrome and other mineral tanning agents.						

Unit:4	Preservation of Hides and Skins and Leather Dyeing	12hours
1. Chemical methods of curing and preservation of hides and skins in acid and alkaline solution. 2. Principles of analytical methods employed in curing, liming, deliming, bating, pickling. Analysis of vegetable tanning materials and extract. 3. Process of dyeing leather- Use of mordants, dyeing auxiliaries such as leveling, wetting and dispersing agents-Dye fixations.		
Unit:5	Source and Treatment of Tannery Effluents	12hours
1. Animal bye-products- their collection, handing and preservation methods (such a shair, blood, bones, glands, Keratinous materials and their utilization). 2. Tannery effluents and treatment: Types of water pollution-physical, chemical, physiological and biological. Different types of tannery effluents and wastes-beam-house waste-liquors-tanning and finishing yard waste liquors, solid waste- origin and disposal.		
	Total Lecture hours	60hours
Reference Book(s)		
1	Tanning Chemistry: The Science of Leather-A. D. Covington, W. R. Wise, Royal Society of Chemistry, 2019.	
2	Tanning processes-A. C. Orthmann, Read Books Publishers, 2011.	
3	The Chemistry of Leather manufacture- G. D. Mclaughlin, Read Books, 2011.	
4	Vegetable tanning materials -F. N. Howes, Butter worths Scientific Publications, 2007.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://blog.walnutstudiolo.com/2019/04/25/kinds-of-leather-by-tanning-process-veg-tan-vs-chrome-tan/	
2	https://www.lowimpact.org/lowimpact-topic/skins-hides/	
3	https://envibrary.com/wastes-from-tannery-industries/	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	M	S	M	S	M	S
CO2	S	S	M	L	M	S	M
CO3	M	L	S	M	M	L	M
CO4	L	M	M	L	M	M	S
CO5	M	M	S	L	M	M	S

*S-Strong; M-Medium; L-Low

Course code	CHEMISTRY OF PLANT BASED PRODUCTS		L	T	P	C
ELECTIVE	Elective II(B)		4	-	-	3
Pre-requisite	Basic Knowledge about Starch, Cellulose and Protein		Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. To impart the knowledge about structure and properties of starch, cellulose and proteins						
2. Describe the students the process involved in the manufacture of them and their applications						
3. To inculcate the chemistry of various cellulose derivatives and their application in paper industry						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the structure, physical and chemical properties and manufacture of starch and their applications					K1-K5
2	Identify the sources, structure, properties and reactions of cellulose					K1, K2, K4
3	Describe the structure, Properties, manufacture and uses of proteins					K1-K5
4	Give the structure of derivatives of cellulose					K1-K3
5	Outline the chemistry behind paper industry with special emphasis on cellulose					K1-K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	Chemistry of Starch					12hours
Structure, physical and chemical properties. Manufacture and uses of unmodified and modified starch, dextrin, sugar syrup, hydrolysis of starch to edible and industrial glucose applications of Starch in textile sizing and in fermentation industries.						
Unit:2	Chemistry of Cellulose					12hours
Structure physical and chemical properties general reactions, major sources and uses of cellulose, chemical and enzymatic hydrolysis of cellulose. Statistics and economics and cellulose. Chemistry of minor products of wood like lignin, pentosans, resin etc, laboratory preparation, manufacture and uses of chemical cellulose.						
Unit:3	Chemistry of proteins					12hours
Structure, Properties, Major sources, technological uses, hydrolysis of proteins and protein isolates. Manufacture, Properties and uses of gelatin, casein, collagen, protein isolates.						
Unit:4	Cellulose Derivatives					12hours
Cellulose nitrate, cellulose acetate, ethyl and methyl cellulose, sodium cellulose sulphate, sodium, carboxy, hydroxyl, methyl, cellulose, regenerated cellulose, major cellulose - plastics - Sodium carboxy methylcellulose.						

Unit:5	Application of Cellulose	12hours
Different methods of pulping, manufacture and uses of different quality of paper products like card-board, newsprint, writing paper, tissue paper and filter paper. A short discussion of the pollution problems and by-products utilization of industries based on starch cellulose and proteins.		
	Total Lecture hours	60hours
Text Book(s)		
1	Fundamentals of Biochemistry-J. L. Jain, S. Jain, N. Jain, S Chand; Seventh edition, 2016.	
2	Cellulose Derivatives: Synthesis, Structure, and Properties–T. Heinze, O. A. ElSeoud, A. Koschella, Springer International Publishing, 2018.	
Reference Book(s)		
1	Starch: Chemistry and Technology-J. N. BeMiller, R. L. Whistler, Academic Press; 3 rd edition, 2009.	
2	Cellulose chemistry and its application-T. P. Nevell, Halsted Press, 1985.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Web sites etc.]		
1	https://starch.eu/starch/	
2	https://en.wikipedia.org/wiki/Cellulose	
3	https://www.youtube.com/watch?v=gDJ0QvtGjVE	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	S	S	M	S
CO2	S	S	M	M	S	S	S
CO3	M	M	M	M	S	M	S
CO4	S	S	S	S	M	S	S
CO5	S	M	S	S	S	S	S

Course code	6EC	DYECHEMISTRY	L	T	P	C
ELECTIVE		Elective II(C)	4	-	-	3
Pre-requisite		Knowledge on Structure of Organic Molecules	Syllabus Version			2025-2026
Course Objectives:						
The main objectives of this course are to:						
1. Outline the fundamentals of volumetric estimations						
2. Explain electrophilic and nucleophilic substitution reactions						
3. Describe the application of boron and silicate chemistry						
4. Discuss thermodynamics and solid-state chemistry						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the principles of color and its relation with compound's structure					K1– K5
2	Analyze and classify dyes based on their chemical structure and applications					K1– K3
3	Describe the synthesis of di and triphenylmethane dyes and their applications					K2, K3,
4	Understand chemistry of nitrogen containing dyes and their applications					K2, K3
5	Outline the importance of pigments in various fields					K1– K4
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Chemistry and Theory of Colors		12hours				
Color and constitution-Relationship of color observed-to wavelength of light absorbed-Terms used in color chemistry-Chromophores, Auxochromes, Bathochromic shift, Hypsochromic shift. Color of a substance-Quinonoid theory and molecular orbital approach.						
Unit:2						
Classification of Dyes		12hours				
Classification of Dyes-chemical classification-classification according to their applications-Acid dyes -Basic dyes. Azoic dyes, mordant dyes, vat dyes, Sulphur dyes, disperse dyes, Nitro dyes-and Nitroso dyes process of dyeing (simple treatment).						
Azo dyes-Principles governing azo coupling-mechanism of diazotization-Coupling with amines, coupling with phenols Classification according to the number of azo group & application-Tautomerism in azo dyes.						
Unit:3						
Synthesis and Applications of Dyes-I		12hours				
Synthesis, reactions and applications of Di and Triphenyl methane dyes-phthalein dyes-Xanthen dyes -acridine dyes-Sulphur dyes. Phthalocyanines- Cyanine dyes. Malachite green, Para-rosoaniline, crystal violet.						

Unit:4	Synthesis and Applications of Dyes-II	12hours
Azine, Oxazine and Triazine Dyes. Synthesis and applications of quinonoid dyes including vat dyes based on anthraquinone.		
Unit:5	Pigments and Their Applications	12hours
Requirements of a pigment: Typical Organic and Inorganic pigments-application and their uses in paints. Reaction of dyes with fibers and water-Fluorescent Brightening agents. Application of dyes in other areas- medicine, chemical analysis, cosmetics, coloring agents, food and beverages.		
	Total Lecture hours	60hours
Text Book(s)		
1	Synthetic Dyes–G. R. Chatwal, Himalaya Publishing House, 2009.	
2	The chemistry of synthetic dyes Vol, I, II, III&IV-K. Venkataraman, Academic Press N. Y., 1949.	
3	The Hand book of Synthetic Dyes and Pigments – K. M. Shah, Publisher Edu tech, 2013.	
Reference Books		
1	The chemistry of synthetic dyes and pigments-H. A. Lubs, New York, Hafner Pub. Co., 1965.	
2	Organic chemistry Vol. I - I. L. Finar, Pearson India, 6 th edition, 2012.	
3	Dyes and Pigments: New Research – A. R. Lang, Nova Science Publishers, Inc.; UK ed. Edition, 2013.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/116/104/116104046/	
2	https://www.internetchemistry.com/chemistry/dye-chemistry.php	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	M	M	M	S	S	M
CO3	S	M	M	M	S	M	M
CO4	S	M	M	M	S	M	S
CO5	S	S	S	S	S	S	S

*S-Strong; M- Medium; L-Low

Course code		ANALYTICAL CHEMISTRY II- LABTECHNIQUES	L	T	P	C
ELECTIVE		Elective III (Group A)	4	-	-	3
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. The students understand the basic principles and components of chromatography						
2. To inculcate the theory, instrumentation and applications of various spectrophotometry						
3. Introduce the theory, techniques and applications of polarimetry and electrochemical Methods						
4. Give an insight into synthesis and purification of some organic and inorganic compounds						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Describe the principles of various chromatography					K1-K4
2	Understand the theory behind UV, IR and NMR spectrophotometry and their applications.					K1-K3
3	Describe the instrumentation of polarimetry					K2, K3
4	Know the various electrochemical methods of analysis and their applications					K2-K4
5	Outline the synthesis and purification steps of some of organic and inorganic compounds.					K2, K3
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Chromatography			12hours			
Classification of the chromatographic methods, principles of differential migration, Adsorption phenomenon, nature of the adsorbent, solvent systems. Rf. Values. Column chromatography, Partition chromatography, paper chromatography, TLC, -theory and techniques.						
Unit:2						
Spectroscopy			12hours			
Theory, instrumentation and application of (i) UV and visible spectrophotometry (ii) IR spectrophotometry (iii) Flame Photometry (iv) NMR spectroscopy						
Unit:3						
Polarimetry			12hours			
Theory, instrumentation, experimental procedure and application.						
Unit:4						
Electrochemical Methods of Analysis			12hours			
Polarography, cyclic voltammetry, differential pulse polarography and calorimetry: Theory, techniques and applications.						
Unit:5						
Preparation and Purification of Compounds			12hours			
Preparation and purification of organic and inorganic compounds like, (i) Aspirin from salicylic acid (ii) Acetanilide from aniline (iii) Benzanilide from aniline (iv) iodoform from methanol and (v) Metadinitrobenzene acetone (vi) Methyl orange/methyl red (vii) preparation of Nylon 66						

(viii) Caffeine from tea leaves (ix) Caesin and lactose from milk (x) Nicotine and Nicotine sulphate (xi) Bakelite from phenol and from tobacco waste formaldehyde (xii)As ₂ O ₃ Sol, Fe (OH) ₃ Sol(xiii) Tetrammine-coppersulphate(xiv)TetrammineCobaltcarbonate(xv)Sodium thiosulphate and(xvi)Cuprous chloride dithionate			
		Total Lecture hours	60hours
Text Book(s)			
1	Vogel's Text Book of Quantitative Chemical Analysis –J. Mendham, RC Denney, JD Barnes, M. Thomas, B. Sivasankar, Pearson Publishers6 th edition2009.		
Reference Book(s)			
1	Physical methods for chemistry-R. S. Drago, W B Saunders Co Ltd; 2nd Revised edition, 1992.		
2	Spectroscopy in Inorganic chemistry-C. N. R Rao and JR Ferraro Academic Press Inc, 1971		
3	Fundamentals of Analytical Chemistry-D. A. Skoog, D. M. West, S. Jose, F. J. Holler Cengage Learning, 2004		
4	Instrumental methods of Chemical Analysis-B. K. Sharma Krishna Prakashan Media(P) Ltd. 2014.		
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]			
1	https://www.youtube.com/watch?v=Zp-BHsdqsRw		
2	https://nptel.ac.in/courses/104/106/104106122/		
3	https://www.slideshare.net/SihamAbdallaha/electrochemical-method-of-analysis-31352857		
4	https://gtu.ge/Agro-Lib/Vogels_TEXTBOOK_OF QUANTITATIVE CHEMICAL ANALYSIS 5th ed-G H Jeffery.MsuCity.pdf		
Course Designed By: Dr. S. Karthikeyan			

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	M	M	M	M
CO2	S	S	S	M	M	M	M
CO3	S	M	M	M	M	L	M
CO4	L	S	M	L	L	M	M
CO5	M	M	L	M	L	M	M

*S-Strong; M-Medium; L-Low

Course code	6EE	ENVIRONMENTALCHEMISTRY	L	T	P	C
ELECTIVE		Elective III(B)	4	-	-	3
Pre-requisite		Basics of Environment Science	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Explain clearly Environmental segments and composition of atmosphere						
2. Understand the Natural Cycles of the environment						
3. Detailed explanation of the different types of pollution						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concepts, environmental segments and composition of the atmosphere				K1, K2	
2	Know about the environment cycles and their significance				K1	
3	Discuss the water pollution, sewage and Industrial waste water treatment				K1, K2	
4	Describe their actions in air pollution, particulates and analysis of pollutants				K2, K4	
5	Explain the thermal, noise and radioactive pollution and their effects and methods of control				K1-K3	
K1-Remember; K2-Understand; K3 -Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1						
Unit:1		Chemistry of Environment and Atmosphere			12hours	
Concept and scope of environmental chemistry-Nomenclature: Pollutant, contaminant, receptor, sink, pathways of a pollutant, speciation, dissolved oxygen, chemical oxygen demand (COD), bio chemical oxygen demand (BOD)-Environmental segments.						
Composition of the atmosphere-atmospheric structure-earth's radiation balance – particles, ions and radicals in the atmosphere-formation of inorganic particulate matter- formation of organic particulate matter-ions and radicals-photo chemical reactions in the atmosphere-formation of NO ₂ , SO ₂ , organic compounds, greenhouse effect.						
Unit:2						
Unit:2		Cycles of Environment			12hours	
Biological cycles & their significance- Gaseous and sedimentary cycles. (a)Oxygen cycle and ozone chemistry (b)Carbon cycle (c)Nitrogen cycle (d)Sulphur cycle (e)Phosphorus cycle						
Unit:3						
Unit:3		Water Pollution and Treatment			12hours	
Water pollution: Hydrological cycle –aquatic environment-classification of water pollution – organic pollutants, inorganic pollutants, sediments, radioactive materials, thermal pollution, BOD & COD –signification-experimental determination. Trace elements in water. Chemical species of copper, lead and mercury. Eutrophication-sewage treatment- primary and secondary treatments. Industrial waste water treatment by 1) activated charcoal /synthetic resins 2) membrane techniques.						

Unit:4	Air Pollution	12hours
1. Air pollutants- primary pollutants- sources of carbon monoxide, nitrogen oxides, Sulphur dioxide; sink and control. Hydrocarbons, photochemical smog, acid rain. 2. Particulates: sources-inorganic and organic particulate matters-effects on human beings, materials, climate control of particulate emission- of atmospheric pollution, corrosion of metals- indoor reactions of air pollutants-sinks of atmospheric gases. Air quality standards: Monitoring –Analysis of carbon monoxide-nitrogen oxides-sulphur dioxides-hydrocarbons.		
Unit:5	Thermal and Electromagnetic Pollution	12hours
1. Thermal pollution-definition, sources-environmental effects- control and prevention. Solar energy as alternative source of energy, strategies for energy conservation. 2. Noise pollution: Sources and effects of noise pollution-control and prevention - solutions to abuse. Supersonic jets and its effects. 3. Radioactive pollution: Sources of radioactive pollution-environmental threat of Nuclear reactors-breeder reactors-environmental conflicts between nuclear powers Methods of control and prevention.		
Total Lecture hours		60hours
Text Book(s)		
1	Environmental Chemistry-A. K. De, New Age International(P) Ltd., New Delhi (2010).	
2	Environmental Chemistry-V. K. Ahluwalia, Ane Books India., New Delhi (2013).	
3	Sodhi, G. S., Fundamantal Concepts of Environmental Chemistry, Narosa Publishing House Pvt. Ltd., New Delhi, Third Edition, (2009).	
Reference Books		
1	A textbook of Environmental Chemistry -Krishnan & Kannan, Anmol Publications, New Delhi (1992).	
2	Environmental chemistry & pollution control–Dhar, S. Chand & Co., New Delhi (1995).	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/122/106/122106030/	
2	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ce57/	
3	https://nptel.ac.in/content/storage2/courses/105101010/downloads/Lecture27.pdf	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	L	S	S	S	M
CO2	S	M	M	S	S	M	S
CO3	M	M	S	S	S	M	S
CO4	S	S	S	M	S	M	S
CO5	S	M	L	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code		TEXTILECHEMISTRY	L	T	P	C
ELECTIVE		Elective III(C)	4	-	-	3
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2025-2026	
Course Objectives:						
The main objectives of this course are to:						
1. Make the students to understand the structure, Properties and uses of natural and synthetic fibers.						
2. Outline the impurities present in cotton and silks and the way to remove them.						
3. Impart the knowledge about various dyes and dyeing of wools and silks						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the structure, production, properties and uses of natural fibers					K1-K3
2	Understand the structure, production, properties and uses of synthetic fibers					K2-K5
3	Identify the impurities present in cotton and silk and know the processes to remove them					K2, K3
4	Describe the various dyeing methods and natural dyes used for cotton fiber					K1-K6
5	Outline different methods available for dyeing wools and silks					K2-K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	Classification and Structure of Natural Fibers					12hours
1. Fiber theory –polymers and polymerization-Morphology of fibers – Molecular arrangements in fibers.						
2. General classification of fibers-chemical structure, production, properties and uses of the following natural fibers (a)natural cellulosic fibers (cotton and jute) (b) natural protein fiber (wool and silk).						
Unit:2	Properties and Uses of Synthetic Fibers					12hours
Chemical structure, production, properties and uses of the following synthetic fibers. (i)Manmade cellulosic fibers (Rayon, modified cellulosic fibers) (ii)Manmade protein fibers (Azions) (iii)Polyamidefibres(differenttypesofnylons)(iv)Polyesterfibres(v)Acrylicfibresand(vi)Olefinfibres.						
Unit:3	Impurities in fibers and their removal					12hours
Impurities in raw cotton and grey cloth, wool and silk-general principles of the removal–Scouring–bleaching–Desizing–Kierboiling–Chemicking–Chemicalandmachineryuse- Degumming and Bleaching of silk Scouring and Bleaching of wool.						
Unit:4	Classification of Dyes					12hours
Dyeing–Classificationofdyesandtheirproperties-applications–direct, basic, Sulphur and azoic dyes On cotton. Application of Vat and solubilized vat dye son cotton and viscose. Mordant mineral colours and black. Application of vegetable and other color to cotton.						

Unit:5	Dyeing of Fibers	12hours
1. Dyeing of wool and silk –Fastnerss properties of dyed materials –dyeing of nylon, terylene and other synthetics. 2. Finishes given to fabrics- Mechanical finishes on cotton, wool and silk, method used process of mercerizing–Anti-crease and Anti-shrink finishes – Waterproofing.		
	Total Lecture hours	60hours
Text Books(s)		
1	Text Book of Applied Chemistry-M. A. Islam, SonaliPublications;1 st edition, 2011.	
2	Chemistry of dyes & Principles of Dyeing-V. A. Shenai, Sevak Publications, 1983.	
Reference Book(s)		
1	The Identification of Textile Fibers–Bruno Luniak, Isaac Pitman & Sons, Limited, 1953.	
2	Dyeing and chemical Technology of Textilefibres-5thEdition, E. R. Trotman, Charles Griffin& Co Ltd, 1970. (Digitalized 2010).	
3	Chemical Technology of fibrous Materials– F. I. Sadov, M. V. Horchaginand A. Matetsky, Mir Publishers, 1978. (Digitalized2008).	
4	Textile Scouring and Bleaching E. R. Trotman, Charles Griffin &Co Ltd. 1968.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://blogionik.org/blog/2017/04/02/natural-synthetic-fiber/	
2	https://www.assignmentpoint.com/science/textile/textile-fiber.html	
Course Designed By: Dr. S. Karthikeyan		

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	M	M	M	S
CO2	M	S	S	M	S	L	M
CO3	M	S	S	S	M	M	L
CO4	S	S	S	M	S	S	M
CO5	S	M	S	S	S	S	M

In order to sustain anti-drug awareness and involve the students as stakeholders in this effort, two programmes have been conceived by Directorate of Collegiate Education (DCE):

(Letter No. RC. No. 40413/Q3/2024, Dated: 03.12.2024)

- a. NSS/NCC/RRC/YRC Volunteers 30 hours volunteering programme.
- b. Anti-Drug Clubs in all educational institutions.

To fulfill the above need, a new course in the name of health and Wellness with the syllabus prescribed in the annexure may be suggested for the students. Kindly ensure the inclusion of the above course in the curriculum and communicate the same to Autonomous (Government, Government Aided and Self-Financing Colleges) in your jurisdiction to follow the same. Please acknowledge the same.

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

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

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

Skill Areas:

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

Purpose:

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

Learning Outcomes:

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

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

Focus:

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

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

Role of the Facilitator:

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

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

Guided Activities:

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

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

Period Distribution

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

The Physical Director should plan the activities by the students.

Arrange the suitable Mentor / Guide for the wellness activities.

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

S.No	Guided Activities	Period
1	Introduction to Holistic Well-being <ol style="list-style-type: none"> 1. Introduce the core components of Health & Well-being namely Physical, mental and emotional well-being 2. Provide worksheets on all the four components individually and explain the interconnectedness to give an overall understanding. 	
2	Wellness Wheel Exercise (Overall Analysis)	

	<ul style="list-style-type: none"> • Guide students to assess their well-being in various life dimensions through exercises on various aspects of well – being, and explain the benefits of applying wellness wheel. • Introduce Tech Tools: • Explore the use of technology to support well-being. • Introduce students to apps for meditation, sleep tracking, or healthy recipe inspiration. 	
3	Breaking Bad Habits (Overall Analysis) <ul style="list-style-type: none"> • Open a discussion on bad habits and their harmful effects. • Provide a worksheet to the students to identify their personal bad habits. • Discuss the trigger, cause, consequence and solution with examples. • Guide them to replace the bad habits with good ones through worksheets. 	
4	Physical Well-being 1. Fitness <p>Introduce the different types of fitness activities such as basic exercises, cardiovascular exercises, strength training exercises, flexibility exercises, so on and so forth. (Include theoretical explanations and outdoor activity).</p> 2. Nutrition <p>Facilitate students to reflect on their eating habits, their body type, and to test their knowledge on nutrition, its sources and the benefits.</p> 3. Yoga & Meditation <p>Discuss the benefits of Yoga and Meditation for one's overall health.</p> <p>Demonstrate different yoga postures and their benefits on the body through visuals (pictures or videos)</p>	

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

	<p>Explain the students that saying 'NO' is important for their Physical and mental well-being, Academic Performance, Growth and Future, Confidence, Self-respect, Strong and Healthy Relationships, building reputation for self and their family (avoid earning a bad name).</p> <p>Factors that prevent them from saying 'NO'.</p> <p>How to practice saying 'NO'.</p> <p>3. Body Positivity and self-acceptance</p> <p>Discuss the following with the students.</p> <ul style="list-style-type: none"> • What is body positivity and self-acceptance? • Why is it important? • Be kind to yourself. • Understand that everyone's unique. <p><u>Suggested Activities(Sample):</u></p> <p>(Importance of saying 'NO')</p> <p>Provide worksheets to self-reflect on...</p> <p>...how they feel when others say 'no' to them</p> <p>...the situations where they should say 'no'</p> <p>Challenge students to write a song or rap about the importance of saying no and how to do it effectively.</p> <p>Students can perform their creations for the class.</p>	
6	<p>Social Well-Being</p> <p>1. Practicing Gratitude</p> <p>Discuss the importance of practicing gratitude for building relationships with family, friends, relatives, mentors and colleagues.</p> <p>Discuss how one can show gratitude through words and deeds.</p> <p>Explain how practicing gratitude can create 'ripple effect'.</p> <p>2. Cultivating Kindness and Compassion</p> <p>Define and differentiate between kindness and compassion.</p> <p>Explore practices that cultivate these positive emotions.</p> <p>Self-Compassion as the Foundation.</p>	

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

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

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

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

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

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

Assessments:

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

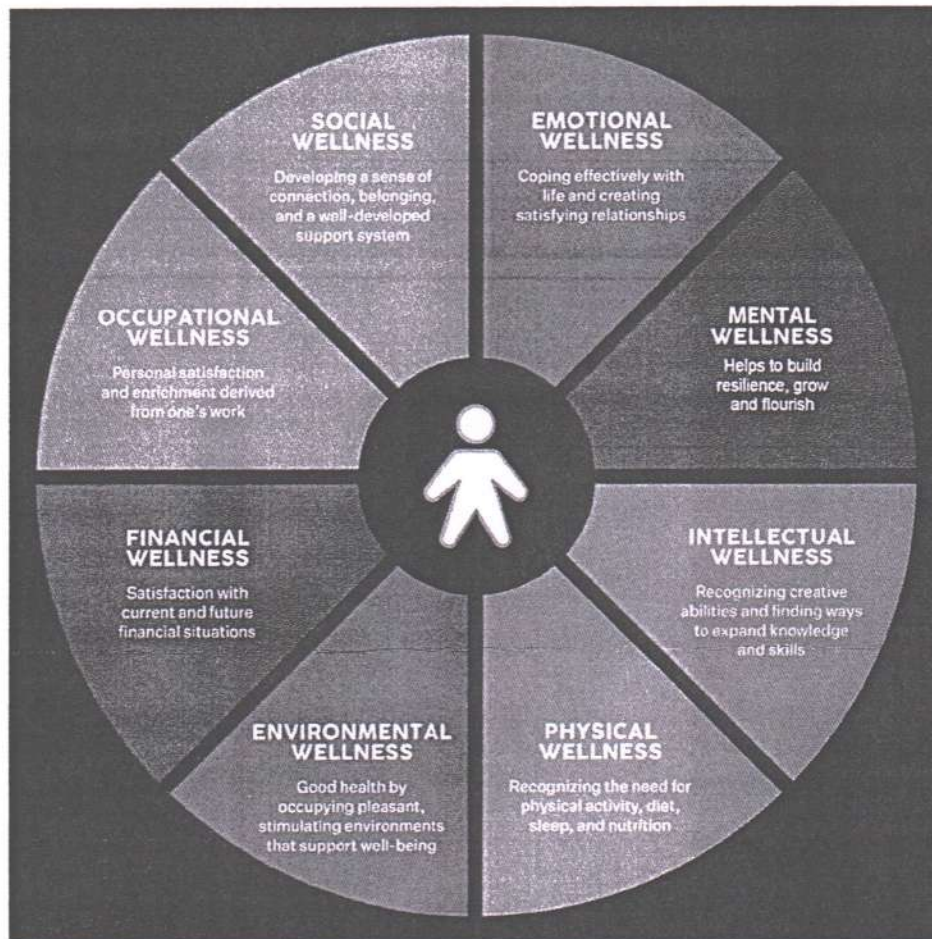
Scheme of Evaluation

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

References/Resource Materials:

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

1. The Well-Being Wheel:



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

3. Online Resources:

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

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