

B. Sc. Chemistry

Syllabus

AFFILIATED COLLEGES

Program Code: 22D

2020 – 2021 onwards

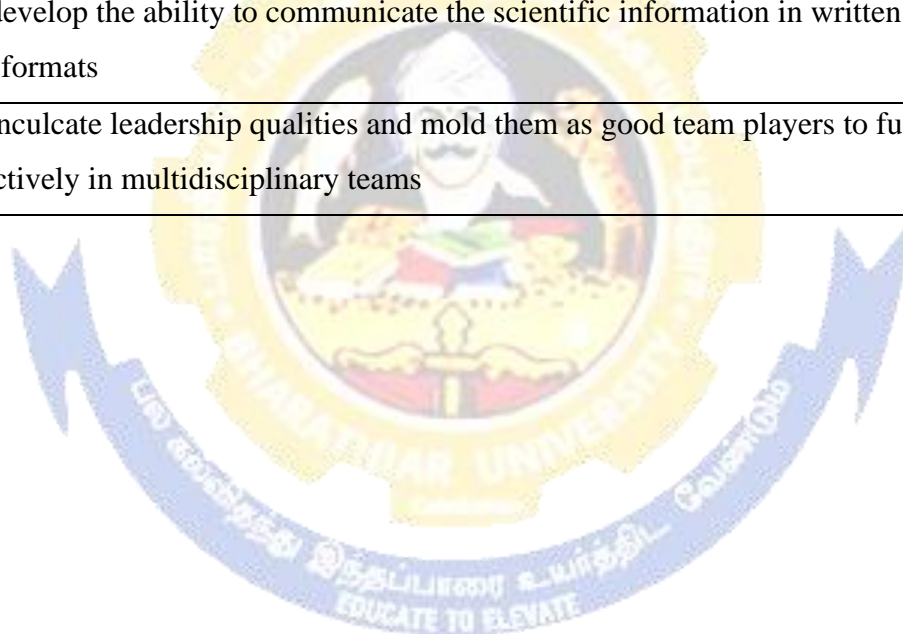


BHARATHIAR UNIVERSITY

(A State University, Accredited with “A” Grade by NAAC,
Ranked 13th among Indian Universities by MHRD-NIRF,
World Ranking : Times - 801-1000, Shanghai - 901-1000, URAP - 982)

Coimbatore - 641 046, Tamil Nadu, India

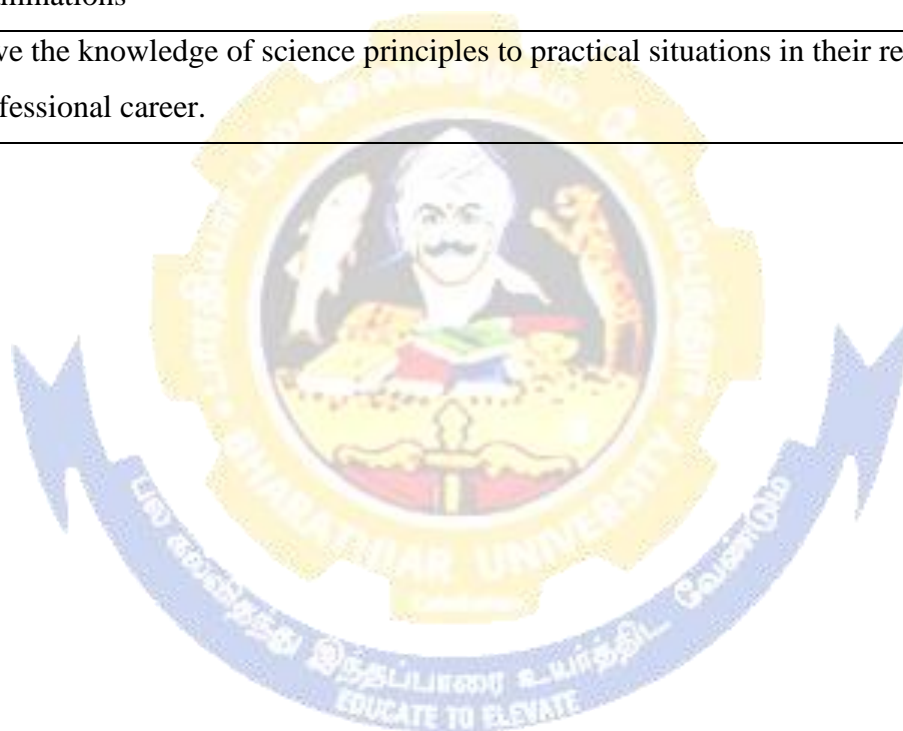
Program Educational Objectives (PEOs)	
The B. Sc. Chemistry program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	To produce efficient chemistry graduates with strong fundamentals in various fields of chemistry
PEO2	To make students capable 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 carry out 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 – Curriculum (Affiliated Colleges)
(For the students admitted during the academic year 2020 – 21 onwards)
Revised Scheme of Examinations (CBCS Pattern)

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
11T	Language – I	4	6	-	25	75	100
12E	English – I	4	6	-	25	75	100
13A	Core I – Paper I General Chemistry I	4	7	-	25	75	100
23P	Core Chemistry Practical - I	-	-	3	-	-	-
	Allied A:Paper I* (or)	4	6	-	25	75	100
	Paper I**	3	4	-	20	55	75
	Allied Practical**	-	-	2	-	-	-
1FC	Environmental Studies #	2	2	-	-	50	50
Total		17	25	5	95	330	425
SECOND SEMESTER							
21T	Language – II	4	6	-	25	75	100
22E	English – II	4	6	-	25	75	100
23A	Core II – Paper II General Chemistry II	4	7	-	25	75	100
23P	Core III – Practical I (Inorganic Qualitative Analysis)	4	-	3	25	75	100
	Allied A:Paper II*(or)	4	6	-	25	75	100
	Paper II**	3	4	-	20	55	75
	Allied Practical**	2	-	2	20	30	50
2FB	Value Education – Human Rights #	2	2	-	-	50	50
Total		23	25	5	140	435	575
THIRD SEMESTER							
31T	Language – III	4	6	-	25	75	100
32E	English – III	4	6	-	25	75	100
33A	Core IV – Paper III Inorganic Chemistry I	4	3	-	25	75	100
33B	Core V – Paper IV Physical Chemistry I	4	3	-	25	75	100
	Core Chemistry Practical - II	-	-	2	-	-	-
	Allied A:Paper II*(or)	4	6	-	25	75	100
	Paper II**	3	4	-	20	55	75

	Allied Practical**	-	-	2	-	-	-
4ZB	Skill based Subject – I Chemistry of Natural and Synthetic Fibers	3	2	-	20	55	75
	Tamil @ / Advanced Tamil# (OR) Non-major elective - I (Yoga for Human Excellence)# / Women's Rights	2	2	-	-	50	50
Total		24	26	4	140	460	600
FOURTH SEMESTER							
41T	Language – IV	4	6	-	25	75	100
42E	English – IV	4	6	-	25	75	100
43A	Core VI - Paper V Organic Chemistry I	4	4	-	25	75	100
43P	Core VII – Practical II (Volumetric and Organic Analysis)	4	-	3	40	60	100
	Allied A: Paper II*(or) Paper II**	4 3	6 4	- -	25 20	75 55	100 75
	Allied Practical**	2	-	2	20	30	50
4ZB	Skill based Subject – II Technology or Dyeing of Natural Fibers	3	3	-	20	55	75
	Tamil @ /Advanced Tamil # (OR) Non- major elective -II (General Awareness #)	2	2	-	-	50	50
Total		26	25	5	175	475	650
FIFTH SEMESTER							
53A	Core VIII – Paper VI Inorganic Chemistry II	4	5	-	25	75	100
53B	Core IX – Paper VII Spectroscopy	4	5	-	25	75	100
53C	Core X – Paper VIII Electrochemistry	4	5	-	25	75	100
53D	Core XI – Paper IX Analytical Chemistry	4	4	-	25	75	100
	Core Chemistry Practical III	-	-	4	-	-	-
5EA	Elective I	4	4	-	25	75	100
5ZC	Skill based Subject – III Water & Effluent Treatment And Pollution Control	3	3	-	20	55	75
Total		23	26	4	145	430	575

SIXTH SEMESTER							
63A	Core XII – Paper X Organic Chemistry II	4	5	-	25	75	100
63B	Core XIII – Paper XI Physical Chemistry II	4	5	-	25	75	100
63P	Core XIV Practical III (Gravimetric And Physical)	4	-	7	40	60	100
6EC	Elective II	3	4	-	20	55	75
6EE	Elective III	3	4	-	20	55	75
63Q	Core XV – Practical for Elective Subjects	4	-	3	40	60	100
6ZP	Skill Based Subject – IV Textile Chemistry Practical	3	-	2	30	45	75
	Extension Activities @	2	-	-	50	-	50
Total		27	18	12	250	425	675
Grand Total		140	145	35	945	2555	3500
* For subjects without practical ** For subjects with practical @ No University Examinations. Only Continuous Internal Assessment (CIA) # No Continuous Internal Assessment (CIA). Only University Examinations.							
Allied Subjects (Colleges can 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 paper as electives)							
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		2019-2020	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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	Periodic Properties and Theory of Bonding				21 hours	
<ol style="list-style-type: none"> 1. Periodic table-Introduction-Periodic properties- Ionisation energy, Electron affinity, Electronegativity and their variations along the period and groups. 2. Hybridization and geometry of BeCl₂, BF₃, CH₄, PCl₅, IF₇ and SF₆. VSEPR Theory. Covalent Bond-Molecular orbital theory-application to molecules such as H₂⁺, He₂, F₂, O₂, N₂, CO and NO. 						
Unit:2	Reaction of Alkenes and Alkynes				21 hours	
<ol style="list-style-type: none"> 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 HgSO₄ catalyst-hydroboration. 						
Unit:3	Polar Effects and Conformations of Alkanes				21 hours	
<ol style="list-style-type: none"> 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 H₂, Br₂ and HI. 						

Unit:4	Liquid Crystals and Black Body Radiation	21 hours
<p>1. Liquid crystals—the concept of mesomorphic state-typical liquid crystalline substances and their properties.</p> <p>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.</p>		
Unit:5	Laws of Thermodynamics	21 hours
<p>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.</p>		
Total Lecture hours		105 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	Text book 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. P. Rajasingh		

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	GENERAL CHEMISTRY - II	L	T	P	C
CORE		Core II – Paper - II	6	1	-	4
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2019-2020	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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 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				21 hours	
<p>1.Principles of Volumetric Analysis: Terms used in volumetric analysis, primary and secondary standard substances, standardization of solutions.</p> <p>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.</p> <p>3. Indicators: Effect of change in pH, neutralization, redox, adsorption and metal ion indicators.</p> <p>4. Oxidation and reduction reactions: balancing redox equations by oxidation number and ion-electron method.</p>						
Unit:2	Boron and Silicates				21 hours	
Chemistry of Boron family – Group discussion – Electron acceptor behaviour 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				21 hours	
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	21 hours
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	21 hours
Crystalline and amorphous solids, crystal systems, Bravais 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, Wurtzite, CaF_2 and TiO_2 - radius ratio rules and packing in crystals.		
Total Lecture hours		105 hours
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%209.pdf	
Course Designed By: Dr. M. Sivakumar		

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 I		-	-	3	4
Pre-requisite		Higher Secondary Level Practical Knowledge		Syllabus Version		2010-2011	
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 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		
ANION 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-BUZWs						
Course Designed By: Dr. S. P. Rajasingh							

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	2020-2021		
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 metals and their compounds					K2,K3
3	Understand and explain the various theories of coordination compounds and stability of metal complexes					K1-K3
4	Define the terms EAN rule classify the organometallic compounds, 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					9 hours
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 GeCl ₄ and TiO ₂						
Unit:2	Extraction of Metals and Their Compounds					9 hours
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	Metal Complexes					9 hours
Limitations of valance bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planer complexes, factors affecting the crystal-field parameters. A brief outline of thermodynamics stability of metal complexes and factors affecting the stability, stability constants of complexes and their determination, substitution reactions of square planar complexes.						

Unit:4	Organometallic Compounds	9 hours
Definition – Nomenclature of Organometallic compounds – 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	Bioinorganic Chemistry	9 hours
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 – enzymes containing essential inorganic elements as cofactors.		
Total Lecture hours		45 hours
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. Sharma and 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 and Reactivity, 4th ed., Harper Collins, 1993.	
2	Lee. J.D, Concise Inorganic chemistry, V edition, Chapman & Hall Ltd, London ,2000	
3	Shriver, D. F.; Atkins, P. W.; Langford, C. H. Inorganic Chemistry, 3rd ed., Oxford University Press, 2000.	
4	Cotton, F. A.; Wilkinson, G.; Murillo, C. A.; Bochmann, M. Advanced Inorganic Chemistry, 6th ed., John Wiley, 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-ordination chemistry, IIT Kharagpur, Prof. D. RaY.	
3	https://youtu.be/FziKko-ZQww for bioinorganic chemistry.	
Course Designed By: Dr. S. P. Rajasingh		

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	PHYSICAL CHEMISTRY - I	L	T	P	C
CORE		Core V – Paper IV	3	-	-	4
Pre-requisite	Basics of Physical Chemistry		Syllabus Version	2020-2021		
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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-Program and evaluate the various parameters.				K2, K5	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	Thermodynamics I				9 hours	
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	Thermodynamics II				9 hours	
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 concept of chemical potential – chemical potential in a mixture of ideal gases – Van't Hoff Isotherm, and isochore – Third law of thermodynamics – statement and applications - Exception to third law.						
Unit:3	Phase Rule				9 hours	
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	9 hours
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 vapour pressure, elevation of boiling point, depression of freezing point and osmotic pressure- their applications.		
Unit:5	C Program for Chemistry	9 hours
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		45 hours
Text Book(s)		
1	Principles of physical chemistry, B.P. Puri, L.R. Sharma and M.S. Pathania, 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, 2013-14 Edn., 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. P. Rajasingh and Dr. A. Thirumoorthi		

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	-	-	2
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2010-2011	
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, ethylene glycol and PET					K1, K3, K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	Natural Textile Fibers					6 hours
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	Viscose Fiber					6 hours
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	Synthetic and Acrylic Fibers					6 hours
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	Nylon Fibers					6 hours
Nylon Fibres: Synthesis of caprolactum from aniline, adipic acid from cyclohexane and hexamethylene diamine from adiponitrile. Polycondensation reactions leading to the formation of Nylon 6 and Nylon 6,6. Properties and uses of Nylon fibers. Structure and uses of Kevlar fibers.						

Unit:5	Reaction of Polyester Fibers	6 hours
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 Polyester fibers.		
Total Lecture hours		30 hours
Text Book(s)		
1	Moses, J. Jeyakodi, 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. (AN 14075527)	
2	"cotton". The Columbia Encyclopedia, Sixth Edition. 2001-07.	
3	A.A.Vidya, ed.: Production of Synthetic Fibers, Prentice-Hall of India, 1988, New-Delhi.	
Reference Books		
1	Stephen Yafa (2004). <i>Cotton: The Biography of a Revolutionary Fiber</i> . Penguin (Non-Classics), 16. ISBN 0-14-303722-6.	
2	Kadolph, Sara J., ed.: <i>Textiles</i> , 10th edition, Pearson/Prentice-Hall, 2007, ISBN 0-13- 118769-4.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.youtube.com/watch?v=ypUkIR894AM	
2	https://www.youtube.com/watch?v=0hoHvN289Xs	
Course Designed By: Dr. S. P. Rajasingh		

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

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



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		2020-2021	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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 alcohols and 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					12 hours
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					12 hours
Mechanism of: - Aldol condensation, Cannizzaro reaction, Perkin reaction, Knoevenagel reaction, Claisen- Schmidt reaction, benzoin condensation, Mannich reaction.						
Unit:3	Active Methylene Compounds					12 hours
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 - cyanoacetic 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	12 hours
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	12 hours
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		60 hours
Text Book(s)		
1	Advanced Organic Chemistry, B.S. Bahl, Arun Bahl, S. Chand & Co.,	
2	Text book Organic Chemistry, P.L. Soni, S.M. Chawla, Sultan Chand & Sons	
Reference Books		
1	Stereochemistry, 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. P. Rajasingh and Dr. A. Thirumoorthi		

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

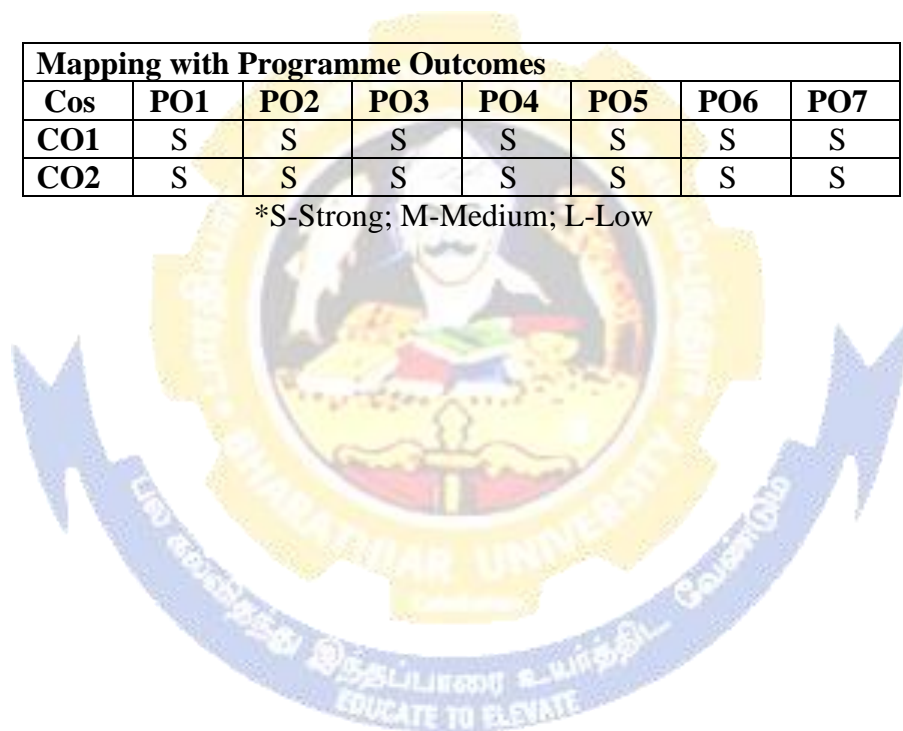
*S-Strong; M-Medium; L-Low

Course code	43P	VOLUMETRIC AND ORGANIC ANALYSIS	L	T	P	C
CORE PRACTICAL		CORE VII - CHEMISTRY PRACTICAL II	-	-	3	4
Pre-requisite		Basics Knowledge on Volumetric and Organic Reactions	Syllabus Version		2010-2011	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> Inculcate the students how to skilfully handle the laboratory equipments, reagents, lab apparatus and preparation of standard solutions. Impart the first-hand knowledge and experience on estimation of an ion, acid and base both directly as well as indirectly. Provide the student knowledge on analysis of an unknown organic substance using Preliminary and confirmation test and prepare a suitable derivative. Make the student skilful enough and prepare for a position in an analytical laboratory or a company. 						
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	45 hours			
A. Acidimetry & Alkalimetry: Estimation of Na ₂ CO ₃						
B. Permanganometry:						
<ol style="list-style-type: none"> Estimation of Ferrous sulphate & Oxalic acid Estimation of Calcium-Direct method. 						
C. Dichrometry: Estimation of Ferrous iron using internal indicator.						
D. Iodimetry:						
<ol style="list-style-type: none"> Estimation of K₂Cr₂O₇ Estimation of Copper. Estimation of As₂O₃. 						
Part II		ORGANIC ANALYSIS	45 hours			
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		90 hours	
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 Britan, 1989
2	Vogel's Textbook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britan, 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. P. Rajasingh	

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

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



Course code	4ZB	TECHNOLOGY OF DYEING OF NATURAL FIBERS	L	T	P	C
SBS		Skilled Based Subject – II	2	-	-	2
Pre-requisite		Basics Knowledge in Fibers	Syllabus Version		2010-2011	
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 fibers, finishes and auxiliaries used in textile industry.						
3. To increase their confidence to cater the needs of industry.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the basic aspects of yarns, it's classification and systematic approach to the applied aspects of twisting of yarns.					K2,K4, K5,
2	Equip with the knowledge of spinning and it's application of fibers after blending with synthetic polymers.					K2,K3
3	Work with various practical aspects of spin finish of textile fibers.					K2,K3
4	Understand the knowledge of dyeing synthetic fibers and boost their confidence to cater the needs of textile industry and market.					K2,K3
5	Explain, discuss and understand the eco-friendly aspects of dyeing with a special reference to dyes.					K3,K4, K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	Classification and Mechanical Properties of Yarns					6 hours
Classification of Yarns: Definition of yarn, classification of yarns - staple yarns, continuous filament yarns and stretch yarns. Definition of twisting of yarns, direction of twist. Mechanical properties of yarns - yarn strength - single thread test.						
Unit:2	Production of Fibers					6 hours
Production of fibers: Melt spinning - definition, simple flow chart, explanation and type of polymers processed. Wet spinning - definition, simple flow chart, explanation and type of polymers processed. Dry spinning - definition, simple flow chart, explanation and type of polymers processed.						
Unit:3	Spin Finish and It's Functions					6 hours
Functions of spin finish, desirable properties of spin finish. Major components of spin finish - lubricant' antistatic agent and emulsifier - one example each with structure. Application of spin finish - dipping roller method.						
Unit:4	Basic Chemistry Behind Dyeing of Textile Fibers					6 hours
Dyeing of textile fibers: Definition of dyeing, Attachment of dye molecules to the fiber – Ionic forces' hydrogen bonds, van der waals' forces and covalent linkages. Important aspects of dyeing of polyester, nylon and acrylic fibers.						

Unit:5	Dyeing of Synthetic Fibers	6 hours
Carrier Dyeing of polyester fibers - characteristics of a carrier, commonly used carriers, advantages of carrier dyeing. Acid dyeing of nylon fibers - definition, two examples and use of leveling agents, examples of anionic, cationic and non-ionic leveling agents. Cationic Dyeing of acrylic fibers - definition, two examples, use of retarders in cationic dyeing.		
Total Lecture hours		30 hours
Text Book(s)		
1	Chakravarthy R. R. 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 380 009.	
2	Gokhle S.V. and Shah. R.C., Cotton Piece dyeing, 1981, Ahmedabad Textile Industrial Research Assn. (ATIRA), PO Polytechnic, Ahmedabad 380 015.	
3	Srivastava S.B., Recent Process of Textile Bleaching, Dyeing and Finishing, 1981, SB Srivastava, S B P Board Consultant, S B P Buildings, 4/45 Roopnagar, Delhi 110 007.	
Reference Books		
1	Shenai V.A., Technology of Textile Processing Vol. 1 and 2, Chemistry of Dyes and Principle of Dyeing Ed. 3, 1983, Sevak Publication, 306, Sri Hanuman Industrial Estate, GC Ambedkar Road, Wadala, Bombay 400 003.	
2	Trotman E.R, Dyeing and Chemical Technology of Textile Fibre, Charles Griffin & Co, 42, Dhury lane, London WC2.	
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. P. Rajasingh		

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	INORGANIC CHEMISTRY - II	L	T	P	C
CORE		Core VIII – Paper - VI	5	-	-	4
Pre-requisite		Basics of Inorganic Chemistry	Syllabus Version		2020-2021	
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 the importance of solvents and solubility in chemical reactions					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		Metals and Solid Solutions			15 hours	
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. Super conductors-An elementary treatment.						
Unit:2		Radioactivity and Nuclear Reactions			15 hours	
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		Isotopes and Their Applications			15 hours	
Nature of isotopes and isobars – detection and isolation of isotopes – various methods – importance of discovery of isotopes – uses of isotopes in various fields. Nuclear stability n/p ratio, magic numbers, C-12 atomic weight scale, C-14 dating, mass defect and nuclear binding energies. Radioactive disintegration series.						

Unit:4	Co-ordination Chemistry	15 hours
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 – hybridisation, 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 $[\text{CoF}_6]^{3-}$, Crystal field theory – spectrochemical series , splitting of ‘d’ metal orbitals in octahedral and tetrahedral complexes, low spin & high spin complexes. Explanation of colour and magnetic properties using CFT, comparison of VBT and CFT.		
Unit:5	Role of Solvents	15 hours
The solvents- solubility of compounds – effect of temperature on solubility- Role of water as solvent- chemical structure and solubility. Classifications of solvents-general behaviour-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.		
Total Lecture hours		75 hours
Text Book(s)		
1	Malik, Wahid U., G.D. Tuli and R.D. Madan . Selected Topics in Inorganic Chemistry, 7 th ed., New Delhi S. Chand & Company Ltd., 2007.	
2	B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi, 1996.	
3	H. J. Arnikar, Essentials of Nuclear Chemistry, 4 th ed., New Age International, New Delhi, 1995.	
Reference Books		
1	J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry, 4 th ed., Harper Collins, New York, 1993.	
2	F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6 th ed., 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. P. Rajasingh		

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		CORE IX - PAPER VII	5	-	-	4
Pre-requisite	Knowledge on basic structure and reactions of simple organic compounds.		Syllabus Version	2020-2021		
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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	Ultra Violet – Visible Spectroscopy				15 hours	
<p>Spectroscopy: Absorption and Emission spectra – Fundamental concepts – Electromagnetic spectrum with relative energies in each region.</p> <p>Ultra Violet – Visible Spectroscopy: Introduction – Beer–Lambert’s law – Instrumentation (block diagram) – Formation of absorption bands – Theory – Types of Electronic Transitions – 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.</p>						
Unit:2	IR and Raman Spectroscopy				15 hours	
<p>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.</p> <p>Raman Spectra: Theory - Comparison of IR and Raman spectra – Applications of Raman Spectra.</p>						

Unit:3	NMR Spectroscopy	15 hours
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	15 hours
Basic Principle – The g factor – Hyperfine splitting – Instrumentation –Applications to methyl radical and Naphthalene negative ion.		
Unit:5	Mass Spectrometry	15 hours
Basic Principles – Theory – The molecular ion – Determination of molecular formula – McLafferty rearrangement – Metastable peaks – Nitrogen rule – Retro Diels –Alder reaction.		
	Total Lecture hours	75 hours
Text Book(s)		
1	Elementary Organic Spectroscopy (Principles and chemical applications) – Y.R. Sharma, S. Chand & Company Ltd. Publications, Fifth revised Ed., 2017.	
2	Organic Spectroscopy (Principles and Applications) – Jag Mohan, Narosa Publishing House, Second Ed., 2012.	
Reference Books		
1	Spectroscopy of Organic compounds – P.S. Kalsi, New Age International Ltd. Publishers, Sixth Ed., 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. A. Thirumoorthi		

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		2016-2017	
Course Objectives:							
The main objectives of this course are to:							
1. Make the students understand basic electrochemical 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		Ionic Equilibrium				15 hours	
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		Conductivity of Ions				15 hours	
Electrical conduction, conduction in metals 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	15 hours
Electrochemical 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- electro chemical series- temperature dependence of the cell EMF- Thermodynamic quantities of cell reactions.		
Unit:4	Electrode Potential	15 hours
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	15 hours
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		75 hours
Text Book(s)		
1	B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co. 33 rd edition, 1992.	
2	S.H. Maron and J.B. Lando, <i>Fundamentals of physical chemistry</i> , Macmillan limited, New York, 1966.	
Reference Books		
1	S.K. Dogra and S. Dogra, Physical chemistry through problems, New age international, 4 th 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. P. Rajasingh and Dr. N. Bhuvaneshwari		

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		2009-2010	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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				12 hours	
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				12 hours	
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				12 hours	
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				12 hours	
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				12 hours	

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
		60 hours
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 & West.	
3	Instrumental Methods of Analysis, Willard, Dean, Merrit and Settle, CBS.	
4	Vogel's Textbook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britan, 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/Chapter s/5. Errors_in_chemical_analysis	
Course Designed By: Dr. S. P. Rajasingh		

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	5ZC	WATER & EFFLUENT TREATMENT AND POLLUTION CONTROL	L	T	P	C
SBS		Skilled Based Subject – III	3	-	-	2
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version		2010-2011	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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 analyzing 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	Sources of Pollution					6 hours
Impact of man on the Environment – an over view 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	Water Pollution and Softening Methods					6 hours
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 – 500 psi. 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					6 hours
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	6 hours
Effect of effluents – General treatment procedure parameters to be determined at Sizing, Desizing, Kier boiling, Bleaching, Mercerizing, Dyeing, Printing, Combined effluent treatment of industrial of 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	6 hours
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, ion exchange chromatography and HPLC.		
Total Lecture hours		30 hours
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. Manivasakam, Sakthi Publications, Coimbatore.	
4	Water used in Textile Processing by N. Manivasakam, Sakthi Publications, Coimbatore.	
5	Tamilnadu state publications and Hand 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. Krishnakumar, 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. P. Rajasingh		

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		CORE XII - PAPER X	5	-	-	4
Pre-requisite	Knowledge on basic structure and reactions of simple organic compounds.		Syllabus Version		2020 - 2021	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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 intramolecular 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 – Racemisation – 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
<p>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.</p>		
Unit:5	Alkaloids and Hormones	15 hours
<p>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.</p>		
Total Lecture hours		75 hours
Text Book(s)		
1	Advanced Organic Chemistry – B.S. Bahl and Arun Bahl, S. Chand & Co., 2012.	
2	Organic Chemistry, R.T. Morrison and R.N. Boyd, Pearson Education, Sixth Ed., 2002.	
3	Text book 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. A. Thirumoorthi		

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 CHEMISTRY II	L	T	P	C
CORE		Core XIII – Paper XI	5	-	-	4
Pre-requisite	Higher Secondary Level Chemistry		Syllabus Version		2010-2011	
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	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 polar gases, liquids and solids-Applications of dipole moment in the study of simple molecules.						
Unit:2	Magnetic Properties of Molecules				15 hours	
Magnetic properties of molecules; Meaning of the terms 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	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 and Zero order reactions. Determination of order of reactions.						

Unit:4	Kinetics of Reaction	15 hours
<p>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.</p>		
Unit:5	Photochemical Reactions	15 hours
<p>Thermal chain reaction H₂/Br₂ reaction. Kinetics of photochemical reactions. Absorption of light and photochemical process. The Stark-Einstein law of photochemical equivalence. Photochemical chain reaction H₂/Br₂ reaction. Quantum yield of photochemical reactions. Comparison of thermal & photochemical kinetics of H₂/Br₂ reaction. Photosensitized reactions. Fluorescence, phosphorescence and chemiluminescence.</p>		
Total Lecture hours		75 hours
Text Book(s)		
1	Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Phathanian, Shobanlal Nagin Chand & Co.	
2	Essentials of Physical Chemistry, B.S. Bahl and 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. Glasstone and D. Lewis, McMillan.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://archive.org/details/2015.135344.ElementsOfPhysicalChemistryEd2nd/page/n9/module/2up	
2	https://nptel.ac.in/content/storage2/courses/122101001/downloads/lec-26.pdf	
3	https://www.youtube.com/watch?v=W8FhIGNmMkg&t=5447s	
Course Designed By: Dr. S. P. Rajasingh		

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		CORE XIV - CHEMISTRY PRACTICAL III	-	-	7	4
Pre-requisite		Basics Knowledge on Analytical and Physical Chemistry	Syllabus Version		2019-2020	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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					45 hours
<ol style="list-style-type: none"> 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					30 hours
<ol style="list-style-type: none"> 1. Estimation of Sulphate as Barium Sulphate 2. Estimation of Calcium as Calcium Oxalate. 						
Part III	Conductometric Physical Experiments					45 hours
<ol style="list-style-type: none"> 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					30 hours
<ol style="list-style-type: none"> 1. Determination of rate constant of acid-catalysed hydrolysis of an ester (Methyl acetate or Ethyl acetate). 2. Determination of dissociation constant of a weak acid (acetic acid). 						
Part V	Temperature Based Physical Experiments					60 hours
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
	210 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	Vogel's Textbook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C 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 (Estimation of Nickel)
3	https://www.youtube.com/watch?v=-GS6uoFf3qQ (strong-acid-strong base)
4	https://www.youtube.com/watch?v=Dc4aUdADqY8 (week acid-strong base)
5	https://www.youtube.com/watch?v=xo1wNSZpE4w (Kinetics of Ester Hydrolysis)
6	https://www.youtube.com/watch?v=5oVnpYhmMVU (CST of Phenol-Water System)
7	https://www.youtube.com/watch?v=2VzEpsEZOY0 (Rast's Macro Method)
Course Designed By: Dr. S. P. Rajasingh	

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	PRACTICAL FOR ELECTIVE SUBJECTS	L	T	P	C
CORE PRACTICAL		CORE XV	-	-	3	4
Pre-requisite		Basics Knowledge on Organic, Inorganic and Physical Chemistry	Syllabus Version		2010-2011	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. Impart skills in the student to analyse a substance by finding their physical constants. 2. Impart knowledge to prepare various organometallic and organic substances using complexation, oxidation, reduction, hydrolysis and other techniques. 3. Make the students learn the technique of estimation of a substance using Complexometric titrations. 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			3 hours	
1. Determination of Melting point/Boiling point of an organic substance.						
Part II		Preparation of Inorganic Complexes			18 hours	
<ol style="list-style-type: none"> (a) Tetrammine copper (II) sulphate (b) Potassium Trioxalato chromate (III) (c) Prussian Blue (d) Hexammine Cobalt (II) chloride (e) Potassium Trioxalato Ferrate(III) (f) Sodium Cuprous Thiosulphate. 						
Part III		Organic Preparation			12 hours	
Preparation involving, Hydrolysis, Oxidation, Halogenation, Nitration and Benzoylation.						
Part IV		Estimation Using EDTA Method			3 hours	
Estimation of Hardness of Water using EDTA.						
Part V		Estimation Using Calorimetric Method			9 hours	
Calorimetric experiments involving Nessler's tubes. <ol style="list-style-type: none"> (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	
					45 hours	
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, G H Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britan, 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. P. Rajasingh	

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

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



Course code	6ZP	TEXTILE CHEMISTRY PRACTICAL	L	T	P	C
SKILL BASED SUBJECT	TEXTILE CHEMISTRY PAPER – IV		-	-	2	3
Pre-requisite	Knowledge of Higher Secondary Level and Dye Chemistry		Syllabus Version		2015-2016	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. Impart skills and knowledge to the students in handling laboratory equipment and reagents 2. Make the students learn the technique in the analysis of water quality using pH and volumetric techniques 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				15 hours	
<ol style="list-style-type: none"> 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				15 hours	
<ol style="list-style-type: none"> 1. Methyl Red 2. Malachite Green 3. Methyl Orange 4. Para nitro benzene azo beta naphthol 5. Azo amino benzene. 						
					Total Practical hours	30 hours
Text Book(s)						
1	Elementary Idea of Textile Dyeing, Printing and Finishing” Kanwar Varinder Pal Singh, Kalyani Publishers, 2009.					
2	Instrumental Methods of chemical <i>Analysis</i> , 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 <i>Analysis</i> , Sixth edition- J Mendham, R C Denney, J D Barnes, M J K 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. P. Rajasingh	

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

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





Elective Course

Course code	SEA	POLYMER CHEMISTRY	L	T	P	C	
ELECTIVE		Elective – I (A)	4	-	-	4	
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version	2019-2020			
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> To understand the types, nature and the various methods of preparation polymers. To learn about the different types of polymerisation reaction mechanism, bonding and properties of polymers. 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		Classification and Preparation of Polymers				12 hours	
<ol style="list-style-type: none"> Classification Of Polymers-Natural Polymers And Synthetic Polymers. Synthetic Polymers- Addition Polymers, Condensation Polymers. Methods Of Preparation Of Polymers-Bulk, Solution ,Suspension And Emulsion. 							
Unit:2		Types of Polymerization				12 hours	
Different Types Of Polymerization-Step Growth Polymerization, Addition Polymerization And Co-Polymerization -Random, Alternate, Block And Graft Polymerization.							
Unit:3		Properties of Polymers				12 hours	
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				12 hours	
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 (Vapour							

pressure) 4. Viscometry Weight Average Molecular Weight Methods. 1. Light scattering Molecular weight distribution.			5. End Group Analysis. 2. Ultra centrifugation		
Unit:5	Industrial Polymers	12 hours			
Important industrial polymers, preparation and applications of i) Polyethylene, polypropylene ii) Polyamides iii) Polyvinyl chloride and polymethyl methacrylate iv) Polyesters and polycarbonates v) Polyurethanes vi) Phenol-formaldehyde and melamine-formaldehyde vii) Polysilanes and polysiloxanes viii) Polyaniline					
Total Lecture hours					60 hours
Text Book(s)					
1	Polymer Science - V R Gowariker; N V 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_RErdKwaAg				
2	https://youtu.be/H1Y1oxQ5eUA				
3	https://youtu.be/7AWQyFr_GLA				
Course Designed By: Dr. S. P. Rajasingh and Dr. K. Velumani					

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	Agro Industrial Chemistry		L	T	P	C
ELECTIVE	Elective I (B)		4	-	-	3
Pre-requisite	Basic Knowledge in Agriculture		Syllabus Version		2010-2011	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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 about soil, 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 & Water Analysis				12 hours	
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				12 hours	
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				12 hours	
Fertilizers: 1. Effect of N, P, K, secondary nutrients and micro nutrients 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 metal.		
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	12 hours
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	12 hours
Classification of oils fats and waxes: distinction between oil, fats and waxes Hydrogenation of oils-principle and manufacturing details. Definition and determination of soapanification value, acid value, iodine value RM value and Hehner value and their signification. Elaidin test for oils. Some common waxes like spermaceti, Bees wax, baybeery wax and their uses. Soap and its manufacture; toilet and transparent soaps. Cleansing action of soap. Detergent.		
Total Lecture hours		60 hours
Reference Book(s)		
1	Nature and properties of soils-Harry, O Buckman N Yle C. Brandy	
2	Soils Science- A. Sankara	
3	Insecticides, Pesticides and Agro based Industries – R.C.Palful, K.Goel, R.K.Gupta	
4	Applied Chemistry- Theory and Practise- O.P.Vermani & A.K.Narula	
5	Industrial Chemistry-B.N Chakrabarty	
6	Industrial Chemistry-B.K.Sharma.	
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. P. Rajasingh		

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		2010-2011	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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 cardiovascular related diseases				K1,K2, K4	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	Introduction to Pharmaceutical Chemistry				12 hours	
<ol style="list-style-type: none"> 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, plaubo, LD50, ed50 and 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-transmuscusal. 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				12 hours	
1. Alkaloids- definition-general methods of isolation-colour tests for identification-source,						

isolation, structure and use of atropine-source, extraction, structure, SAR and uses of morphine and quinine.

2. Analgesics-definition different types of pain (superficial, deep non visceral, visceral, referred and psychogenic), classification – morphine and its derivatives. Synthesis assay and uses of pethidine and methadone-antipyretic analgesics-salicylic acid derivatives-paracetamol, phenacetin-propanoic acid derivative-Ibuprofen.

3. Antibiotics: definition –microbial synthesis structure, assay and uses of chloramphenicol and penicillin-structure and use of streptomycin and tetracyclines.

4. Sulphanamides: Definition-mechanism of action-classification-SAR- synthesis and use of sulpha acetamide, sulphathiazole, phthalyl sulphathiazole- sulphadiazine and sulpha pyridine-assay.

Unit:3

Molecules to Medicine

12 hours

1. Antiseptics and disinfectants: Definition and distinction- phenol coefficient- examples-phenolic compounds, dyes, cationic surfactants and chloro compounds. Tranquilizers-definition and examples. Psychedelic drugs LSD and marijuana.

2. Anaesthetics – Definition –Classification –volatile anaesthetics (N₂O, ethers, halohydrocarbons, chloroform, haloethane)-ferguson principle –intravenous anaesthetics-structure of thiopental sodium-local anaesthetic cocaine-source and structure – preparation and uses of procaine orthocaine and benzocaine.

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).

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)

Unit:4

Medicinally Important Compounds

12 hours

1. Medicinally important compounds of Al₂P₂As, Hg and Fe. Uses of the following MgSO₄ 7H₂O, milk of magnesia, magnesium trisilicate-Aluminium hydroxide gel, dihydroxy aluminium amino acetate, Aluminium acetate and aluminium monostearate-paroxon-phosphorine, cyclophosphomide-tricyclophos-preparation and use of thiotepa-sodium and copper cacodylates-preparation and uses of aromatic aresericals (carbosone, triparasomide, acetarsonide, neoarsphenamine, oxophenarisince) - HgCl₂, Hgl₂ and Hg(CN)₂ as disinfectations-importance of organic mercury compounds-structure and uses of thiomersal, netromersal merbromine and mersalyl acid-Ferrous gluconate, FeSO₄, scale preparation (ferric ammonium acetate), ferrous fumarate, ferrous succinate and ferrous chlorinate.

2. Organic pharmaceutical aids-Definition-agents for kidney function (aminophippuric acid)-liver function (sulphobrophthalein sodium, rose Bengal)-corneal ulcer detection (Fluoescein sodium)-Blood volume determination (Evans Blue) pituitary function (metyrapone)-ointment bases-preservatives-antioxidants-sequestants, colouring, sweetening, flavouring, emulsifying and stabilizing agents.

3. AIDS-cause HIV-propagation-prevention and treatment.

Unit:5	Cardiovascular and related drugs	12 hours
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		60 hours
Reference Book(s)		
1	Pharmaceutical Chemistry by S. Lakshmi, Sultan Chand & Sons, 2 nd ed (1998).	
2	Pharmacology and pharmatherapeutics, Vol.1 & 2, R.S. Satoskar and S.D. Bhandarkar 11 th Ed, Popular prakashan, Mumbai, 1989.	
3	Bentleys, Text book of pharmacutics, 8th Ed. E.A. Raubins, 1992, All India traveller book sellers, Delhi.	
4	Medicinal Chemistry, Ashutosh kar, New Age International, 1992.	
5	A text book of pharmaceutical chemistry, Jayashree Ghosh, S. Chand, 1997.	
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=9xSqezCMHnw	

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

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

Course code	Leather Chemistry		L	T	P	C
ELECTIVE	Elective II (A)		4	-	-	3
Pre-requisite	Higher Secondary Level Chemistry		Syllabus Version		2010-2011	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> To understand the basics of skins, leather and their composition. Impart the principle involved in pre-tanning and structure and process of various tannings Inculcate the methods of curing hides and skins and process of dyeing leather Knowledge on the water pollution by tannery industry and its 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	Interpret the chemistry behind the chrome tanning process				K2-K4	
4	Analyze the process involved in curing 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	Hides, Skins and Leather				12 hours	
<ol style="list-style-type: none"> 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). 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	Types of Natural and Synthetic Tannings				12 hours	
<ol style="list-style-type: none"> Types of tanning-vegetable and mineral tanning, Different types of vegetable tanning-materials classification and chemistry of vegetable tanning. Factors and Physio-chemical principle involved in vegetable tanning, Fixation of vegetable tanning. Synthetic tannings-their classifications, general methods of manufacture and use. 						
Unit:3	Chemistry of Chrome Tanning				12 hours	
<ol style="list-style-type: none"> 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, Zr and Te salts and their relative merit in contrast with chrome tanning 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	12 hours
<p>1. Chemical methods of curing and preservation of hides and skins in acid and alkaline solution.</p> <p>2. Principles of analytical methods employed in curing, liming, deliming, bating, pickling. Analysis of vegetable tanning materials and extract.</p> <p>3. Process of dyeing leather-Use of mordants, dyeing auxiliaries such as levelling, wetting and dispersing agents-Dye fixations.</p>		
Unit:5	Source and Treatment of Tannery Effluents	12 hours
<p>1. Animal by-products-their collection, handling and preservation methods (such as hair, blood, bones, glands, Keratinous materials and their utilization).</p> <p>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.</p>		
Total Lecture hours		60 hours
Reference Book(s)		
1	Chemical technology of Leather (ISI).	
2	Fundamentals of Leather Science-Woodroffe.	
3	Tanning processes-Crthmann.	
4	Chemistry of Leather manufacture-Mchanghlils.	
5	Vegetable tanning materials-Howes.	
6	Publications of CLRI-Madras.	
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. P. Rajasingh		

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	2010-2011		
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					12 hours	
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					12 hours	
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, resins etc, laboratory preparation, manufacture and uses of chemical cellulose.							
Unit:3	Chemistry of proteins					12 hours	
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					12 hours	
Cellulose nitrate, cellulose acetate, ethyl and methyl cellulose, sodium cellulose sulphate, sodium, carboxy, hydroxyl, methyl, cellulose, regenerated cellulose, major cellulose-platics-sodium carboxy methyl cellulose.							

Unit:5	Application of Cellulose	12 hours
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		60 hours
Reference Book(s)		
1	Textbook of Biochemistry-K. Ranganatha rao, Prentice Hall (1975).	
2	Biochemistry-S.K. Dasgupta, Macmillan (1977).	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites 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. P. Rajasingh		

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

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

Course code	6EC	DYE CHEMISTRY	L	T	P	C
ELECTIVE		Elective II (C)	4	-	-	3
Pre-requisite		Knowledge on Structure of Organic Molecules	Syllabus Version		2019-2020	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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 colour 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 triphenyl methane 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 Colours				12 hours	
Colour and constitution-Relationship of colour observed-to wave length of light absorbed-Terms used in colour chemistry-Chromophores, Auxochromes, Bathochromic shift, Hypsochromic shift. Colour of a substance-Quinonoid theory and molecular orbital approach.						
Unit:2	Classification of Dyes				12 hours	
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				12 hours	
Synthesis, reactions and applications of Di and Triphenyl methane dyes-phthalein dyes-Xanthen dyes-acridine dyes-sulphur dyes. Phthalocyanines-Cyanine dyes. Malachite green, Para-Rosaniline, crystal violet.						

Unit:4	Synthesis and Applications of Dyes - II	12 hours
Azine, Oxazine and Triazine Dyes. Synthesis and applications of quinonoid dyes including vat dyes based on anthraquinone.		
Unit:5	Pigments and Their Applications	12 hours
Requirements of a pigment: Typical Organic and Inorganic pigments-application and their uses in paints. Reaction of dyes with fibres and water-Fluorescent Brightening agents. Application of dyes in other areas-medicine, chemical analysis, cosmetics, colouring agents, food and beverages.		
Total Lecture hours		60 hours
Text Book(s)		
1	Dyes and their intermediates-E.N. Abraha, Bergamon Press, 1969.	
2	The chemistry of synthetic dyes and pigments-H.A.Lubs, ACS Publication, Halner, 1970.	
3	The chemistry of synthetic dyes Vol, I, II, III & IV- K.Venkataraman, Academic Press N.Y., 1949.	
Reference Books		
1	Physical and Chemistry applications of dyestuffs- F.P. Schafer, Springer-Veriag N.Y.1976.	
2	Organic chemistry Vol.I- I.L. Finar, ELBS.	
3	Modern paint pigment and Varnish –S.K. Jain & S.K. Malik, Industries Small business Publication, New Delhi.	
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. P. Rajasingh		

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-LAB TECHNIQUES		L	T	P	C
ELECTIVE	Elective III (Group A)		4	-	-	3
Pre-requisite	Higher Secondary Level Chemistry		Syllabus Version		2010-2011	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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				12 hours	
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				12 hours	
Theory, instrumentation and application of (i) UV and visible spectrophotometry (ii) IR spectrophotometry (iii) Flame Photometry (iv) NMR spectroscopy						
Unit:3	Polarimetry				12 hours	
Theory, instrumentation, experimental procedure and application.						
Unit:4	Electrochemical Methods of Analysis				12 hours	
Polarography, cyclic voltametry, differential pulse polarography and calorimetry: Theory, techniques and applications.						
Unit:5	Preparation and Purification of Compounds				12 hours	
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 ethanol/and (v) Meta di nitro benzene 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-copper sulphate (xiv) Tetrammine Cobalt carbonate (xv) Sodium thiosulphate and (xvi) Cuprous chloride dithionate	
	Total Lecture hours 60 hours
Reference Book(s)	
1	Physical methods of chemistry- R.S. Drago.
2	Spectroscopy in Inorganic chemistry-C.N.R. Rao and JR Ferraro.
3	Analytical Chemistry-R. V. Dills.
4	Fundamentals of Analytical Chemistry-D.A. Skoog and D.M. West.
5	Instrumental methods of Chemical Analysis-Ewing.
6	Quantitative Chemical Analysis-A.I. Vogel.
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
Course Designed By: Dr. S. P. Rajasingh	

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	ENVIRONMENTAL CHEMISTRY	L	T	P	C
ELECTIVE		Elective III (B)	4	-	-	3
Pre-requisite		Basics of Environment Science	Syllabus Version		2019-2020	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 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 the reactions 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	Chemistry of Environment and Atmosphere					12 hours
Concept and scope of environmental chemistry-Nomenclature: Pollutant, contaminant, receptor, sink, pathways of a pollutant, speciation, dissolved oxygen, chemical oxygen demand (COD), biochemical 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-photochemical reactions in the atmosphere-formation of NO ₂ , SO ₂ , organic compounds, greenhouse effect.						
Unit:2	Cycles of Environment					12 hours
Biological cycles & their significance-Gaseous and sedimentary cycles. (a) Oxygen cycle and ozone chemistry (b) Carbon cycle (c) Nitrogen cycle (d) Sulphur cycle (e) Phosphours cycle						
Unit:3	Water Pollution and Treatment					12 hours
Water pollution: Hydrological cycle –aquatic environment-classification of water pollution – organic pollutants, inorganic pollutants, sediments, radioactive materials, thermal pollution, BOD & COD –signification-experimandal determination. Trace elements in water. Chemical speciation of copper, lead and mercury. Eutrophication-sewag treatment-primary and secondary treatments. Industrial waste water treatment by 1) activated charcoal/synthetic resins 2) membrane techniques.						
Unit:4	Air Pollution					12 hours
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	12 hours
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
		60 hours
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., Fundamental Concepts of Environmental Chemistry, Narosa Publishing House Pvt. Ltd., New Delhi, Third Edition, (2009).	
Reference Books		
1	A text book 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. P. Rajasingh and Prof. C. Sudhakar		

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	TEXTILE CHEMISTRY			L	T	P	C
ELECTIVE	Elective III (C)			4	-	-	3
Pre-requisite	Higher Secondary Level Chemistry			Syllabus Version	2010-2011		
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					12 hours	
1. Fibre theory –polymers and polymerization-Morphology of fibres – Molecular arrangements in fibres.							
2. General classification of fibres–chemical structure, production, properties and uses of the following natural fibres (a)natural cellulosic fibres (cotton and jute) (b) natural protein fibre (wool and silk).							
Unit:2	Properties and Uses of Synthetic Fibers					12 hours	
Chemical structure, production, properties and uses of the following synthetic fibres. (i) Man made cellulosic fibres (Rayon, modified cellulosic fibres) (ii) Man made protein fibres (Azions) (iii) Poly amide fibres (different types of nylons) (iv) Poly ester fibres (v) Acrylic fibres and (vi) Olefin fibres.							
Unit:3	Impurities in fibers and their removal					12 hours	
Impurities in raw cotton and grey cloth, wool and silk- general principles of the removal – Scouring – bleaching – Desizing – Kierboiling- Chemicking –Chemical and machinery use- Degumming and Bleaching of silk Scouring and Bleaching of wool.							
Unit:4	Classification of Dyes					12 hours	
Dyeing – Classification of dyes and their properties- applications – direct, basic, sulphur and azoic dyes on cotton. Application of Vat and solubilised vat dyes on cotton and viscose. Mordant mineral colours and black. Application of vegetable and other colour to cotton.							

Unit:5	Dyeing of Fibers	12 hours
1. Dyeing of wool and silk –Fastners 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 –Water proofing.		
Total Lecture hours		60 hours
Reference Book(s)		
1	Chemical Technology of fibrous Materials – F. Sadov, M. Horchagin and A. Matetshy, Mir Publishers.	
2	The Identification of Textile Fibres – Bruno Nuntak.	
3	Introduction to Textile Science -3 rd edition, Maryory L.Joseph.	
4	Textile Chemistry –Vol.II R.H.Peters, Elsevier, Amsterdam.	
5	Dyeing and chemical Technology of Textile fibres-5th Edition, E.R.Trotman, Charles Griffin & Co Ltd.	
6	Chemistry of dyes & Principles of Dyeing -V.A.Shenai, Sevak Publications.	
7	Scouring and Bleaching E.R.Trotman, Charles Griffin & Co Ltd.	
8	Text Book of Applied Chemistry- K.Kapur	
9	A Students Text Book of Textile Science- A.J.Hall	
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. P. Rajasingh		

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

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





Allied Course

Course code	Allied Chemistry - I			L	T	P	C
Allied	Allied I – Paper - I			4		-	3
Pre-requisite	Higher Secondary Level Chemistry			Syllabus Version	2020 - 2021		
Course Objectives:							
The main objectives of this course are to:							
<ol style="list-style-type: none"> 1. Explain the conducting properties of metals. 2. Outline the reactivity of boron compounds, the principles of bonding, hybridisation and stereochemistry 3. To imbibe the knowledge of silicones, fuel gases, dyes and their industrial applications 4. To inculcate the chemistry behind day to day used items like toiletries, detergents etc 5. Explain the physical chemistry behind the reaction rates and solutions. 							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand the properties metals and their conductivity, the principle behind the synthesis and applications of boron compounds.					K1-K4	
2	Understand about silicones fuels gases and their industrial applications. The theory behind colours and dyes, their preparation and dyeing.					K2-K4, K6	
3	Understand the bonding and structure of various hydrocarbons and electronic effects. Appreciate the optical properties of compounds and how it determines the compounds nature itself					K1-K4	
4	Explain the chemistry behind toiletries and cleaning agents.					K2-K5	
5	Understand the kinetics behind chemical reactions and the nature of solutions					K1-K3	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create							
Unit:1	Conductivity of Metals and Boron Compounds					12 hours	
1. Conductivity of metals: Band theory, Explanation of thermal and electrical conductivity of metals, limitations, Definition and examples of conductors, semiconductors and insulators. 2. Boron compounds: Structure, preparation, properties and uses of NaBH ₄ , Diborane and Borazole.							
Unit:2	Industrial and Dye Chemistry					12 hours	
1. Industrial Chemistry: Synthesis, properties and uses of silicones. Fuel gases: composition and uses of natural gas, water gas, semi water gas, carbureted water gas, producer gas, oil gas. 2. Dye Chemistry: Terms: Chromophore – auxochrome - bathochromic shift - hypsochromic shift - hyperchromic effect - hypsochromic effect - Dyes: Azo and triphenyl methane dyes - Preparation of Methyl Orange and Malachite green.							
Unit:3	Covalent Bonding and Stereoisomerism					12 hours	
1. Covalent bond: Orbital overlap – hybridization - geometry of organic molecules- CH ₄ , C ₂ H ₄ , and C ₂ H ₂ . Definition with example: Inductive, Electromeric, Mesomeric, hyperconjugative and steric effect. 2. Stereoisomerism: Conditions of optical activity - optical isomerism of lactic acid and tartaric acid - geometrical isomerism of maleic and fumaric acids.							

Unit:4	Chemistry of Toiletries and Cleaning Agents	12 hours
1. Toiletries: Bath soap – shower gel - water softeners - tooth pastes-ingredients - their characteristic functions-mouth washes-shaving creams-after shave preparations. 2. Cleaning Agents: Detergents - classification - formulation-cleansing action-optical brighteners-bleachers-phenoyls - hand sanitizer.		
Unit:5	Physical Chemistry: Solutions and Kinetics	12 hours
1. Solutions: Raoult's law - Deviation from ideal behaviour - positive deviation - Negative deviation - Fractional distillation. 2. Kinetics: Rate - order - molecularity - pseudo first order - determination of order by graphical method - Effect of temperature on the rate - Energy of activation.		
Total Lecture hours		60 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	Principles of Physical Chemistry, B.P. Puri, L.R. Sharma and M.S. Phathania, S. Chand & Company	
Reference Books		
1	Advanced Organic Chemistry, B.S. Bahl, Arun Bahl, S. Chand & Co.,	
2	Perfumes, Cosmetics and Soaps, W.A.Poucher (Vol.3), 9 th Edition, Springer Science Business Media, 1993.	
3	Handbook of Cosmetic Science and Technology, Barel, A.O.; Paye, M.; Maibach, H.I. (2014), CRC Press.	
4	Pharmaceutics and Cosmetics, Gupta, P.K.; Gupta, S.K.(2011), Pragati Prakashan.	
5	Chemical Process Industries, R. Norris Shreve and Joseph A.Brink,Jr.,4 th Edition, McGraw Hill, 1977.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/104/103/104103071/	
2	https://www.youtube.com/watch?v=zdmEaXnB-5Q	
3	https://www.britannica.com/science/band-theory	
4	https://www.chem.purdue.edu/gchelp/solutions/whatis.html	
Designed By: Dr. S. P. Rajasingh		

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

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

Course code	Allied Chemistry - II		L	T	P	C
Allied	Allied I – Paper - II		4		-	3
Pre-requisite	Higher Secondary Level Chemistry		Syllabus Version	2020-2021		
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> To explain bioinorganic chemistry in biological systems. Appreciate the need for paints and explosives. To understand the role of polymers and rubbers to mankind. Show the importance of fertilizers and the unavoidability of insecticides in agriculture. Explain the electrochemistry and electrical storage. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Appreciate the role of metals in biological system and their therapeutic effects				K1-K3	
2	Understand about the importance of paints and the need for explosives as well as the bad face of war.				K2-K5	
3	Understand the importance of polymers and rubbers in our day to day life				K1-K4	
4	Appreciate the need for fertilizers and insecticides in the Agricultural sector				K2-K5	
5	Understand the importance of electrochemistry and energy storage devices				K2-K4	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	Coordination Chemistry and The Importance of Metals				12 hours	
<ol style="list-style-type: none"> Coordination chemistry: Chelation examples - Hemoglobin – Chlorophyll - Applications of EDTA in qualitative and quantitative analysis. Metals in Health: Application of therapeutic chelating agents- Metal-based drugs cis-platin, carboplatin, platinum anti-cancer drugs, gadolinium MRI contrast agents, Gold arthritic agents. 						
Unit:2	Paints and Explosives				12 hours	
<ol style="list-style-type: none"> Paints: classification – constituents – Pigment Volume Concentration – Distemper – Varnishes – Lacquers - Pigments – name and formula of different coloured pigments and their uses – Toners – Nano paints. Explosives: classification – characteristics – chemistry of Nitrocellulose – nitroglycerine - gun powder - RDX – mustard gas – phosgene - nerve gas – Screening smokes. 						
Unit:3	Polymers and Rubbers				12 hours	
<ol style="list-style-type: none"> Polymers: Preparation, properties and uses of: Poly olefins – Polythene – PTFE – Freons - PVC, - Polypropylene – Polystyrene. Rubbers: Natural and synthetic rubbers: Constitution of natural rubber – Butyl - Buna-N – Neoprene – Thiocol – Polyurethane - Silicone rubbers. 						
Unit:4	Agricultural Chemistry – Fertilizers and Insecticides				12 hours	
<ol style="list-style-type: none"> Fertilizers: Classification of fertilizers- Preparation and uses of Urea, DAP, NPK, SSP, TSP and bio-fertilizers (vermicompost, coircompost, panchakavia) – types and advantages of 						

biofertilizers.		
2. Insecticides: Classification of insecticides – Structure and effects of dinitro phenols, DDT, methoxychlor and BHC – comparison of artificial pesticides and bio-pesticide.		
Unit:5	Electrochemisry, Fuel cells and Energy Storage	12 hours
1. Electrochemistry: EMF (Definition) - Daniel cell - Reference electrode - Standard Hydrogen Electrode (SHE) -Saturated Calomel Electrode (SCE). Determination of pH - glass electrodes.		
2. Fuel cell and Energy storage: Hydrogen - Oxygen fuel cell – Batteries: Lead-storage battery - Batteries of future: Lithium ion batteries.		
Total Lecture hours		60 hours
Text Book(s)		
1	Principles of physical chemistry, B.P. Puri, L.R. Sharma and M.S. Phathania, S. Chand & Company	
2	Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons.	
3	Principles of Inorganic Chemistry, B.R. Puri L.R. Sharma, S. Chand & Co.	
4	Engineering Chemistry by Jain and Jain; Dhanpat Rai Publication Co. 2014.	
Reference Books		
1	Environmental Chemistry, A.K. De, 6 th Edition, New Age International, New Delhi, 2006.	
2	A Text Book of Environmental Chemistry and Pollution Control, S.S. Dara–S. Chand Publication 2012.	
3	Chemical Process Industries, R. Norris Shreve and Joseph A.Brink,Jr.,4 th Edition, McGraw Hill, 1977.	
4	History of fertilizer chemistry by T.P. Hignett, SPRINGER ,1985	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc19_cy26/preview	
2	https://nptel.ac.in/courses/126/105/126105014/	
3	https://nptel.ac.in/content/storage2/courses/103107086/module1/lecture1/lecture1.pdf	
4	https://nptel.ac.in/content/storage2/courses/108103009/download/M9.pdf	
5	https://nptel.ac.in/courses/113105028/	
6	https://www.youtube.com/watch?v=no4vRKvKxcU	
7	https://www.youtube.com/watch?v=5XKpJ24P-KE	
Designed By: Dr. S. P. Rajasingh		

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

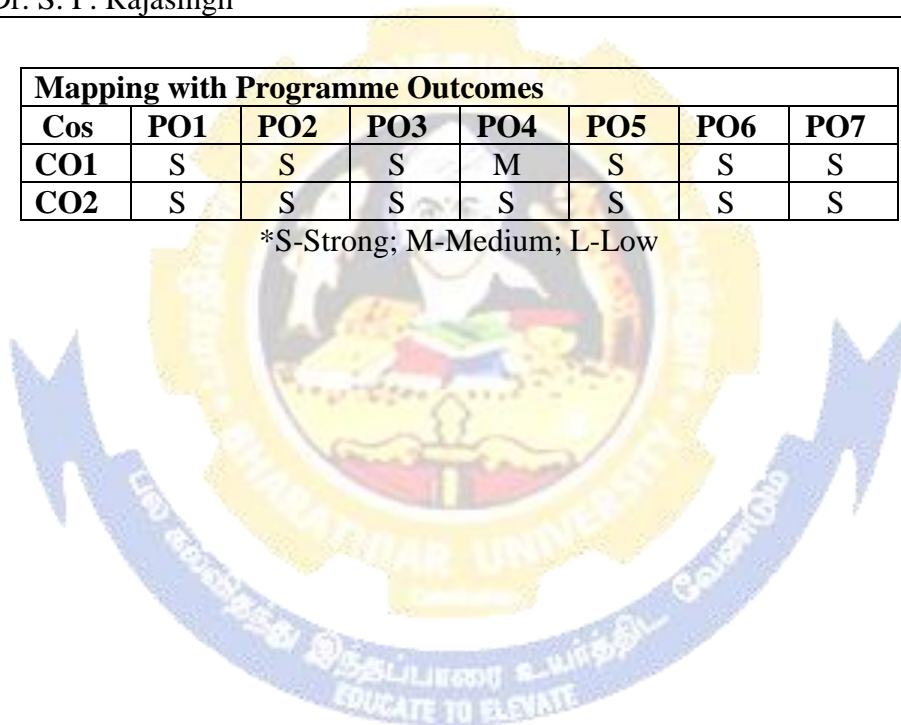
*S-Strong; M-Medium; L-Low

Course code	2PH	Chemistry Practical	L	T	P	C
Allied		Allied Chemistry	-	-	2	3
Pre-requisite		Higher Secondary Level Lab Knowledge	Syllabus Version		2018-2019	
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 5. Inculcate the students how to handle the basic laboratory apparatus and perform tests. 6. Impart the first-hand knowledge and experience on estimation of an ion, acid and base. 7. Provide the student knowledge on analysis of an unknown organic substance using Preliminary and confirmation test. 8. Make the student skilful enough and prepare for a position in an analytical laboratory or a company. 						
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				K1-K6	
2	Find the groups/elements and characters present in the given organic substance through qualitative analysis				K1-K6	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Part I		VOLUMETRIC ANALYSIS			30 hours	
<ol style="list-style-type: none"> 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid- standard oxalic acid. 3. Estimation of oxalic acid- standard sulphuric acid. 4. Estimation of ferrous sulphate- standard Mohr salt solution. 5. Estimation of oxalic acid- standard ferrous sulphate. 						
Part II		ORGANIC ANALYSIS			30 hours	
Systematic Qualitative Analysis of given Organic Substance and Report on the following						
<ol style="list-style-type: none"> 1. Detection of Elements (N, S, Halogens). 2. To distinguish between aliphatic and Aromatic. 3. To distinguish between saturated and unsaturated. 4. Functional group tests for phenols, acids (mono and di), aromatic primary amine, amide, diamide, carbohydrate, Functional groups characterized by confirmatory test. 						
					Total Practical hours	
					60 hours	
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	Vogels Text book of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Fifth Edition, Bath Press, Great Britan, 1989.
2	Vogels Text book of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britan, 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	https://www.toppr.com/guides/chemistry/organic-chemistry/qualitative-analysis-of-organic-compounds/
4	https://www.youtube.com/watch?v=7bmQkQW8bbs
5	https://www.youtube.com/watch?v=wRAo-M8xBHM
Designed By: Dr. S. P. Rajasingh	

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

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





Annexure

B. Sc. CHEMISTRY



**Syllabus
(2020-2021)**

Program Code:



**DEPARTMENT OF CHEMISTRY
(Affiliated Colleges)
Bharathiar University
(A State University, Accredited with “A” Grade by NAAC and
13th Rank among Indian Universities by MHRD-NIRF)
Coimbatore 641 046, INDIA**

BHARATHIAR UNIVERSITY: COIMBATORE 641046
DEPARTMENT OF CHEMISTRY
(Affiliated Colleges)

The logo of Bharathiar University is a circular emblem. It features a central figure, likely a deity or a historical figure, surrounded by a gear-like border. The text 'BHARATHIAR UNIVERSITY' is written in a circular path around the central figure. Below the main emblem, there is a blue banner with the motto 'EDUCATE TO ELEVATE' in English and its Tamil equivalent.

MISSION

To provide the fundamental knowledge of chemistry, empower students for higher studies and acquire potential jobs.