B. Sc. Chemistry

Syllabus

AFFILIATED COLLEGES

Program Code: 22D

2021 – 2022 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 – Revised Scheme of Examinations (CBCS Pattern)

(For the students admitted during the academic year 2021 – 22 onwards)

Part	Title of the Course	Hours/ Week	Examination				Credits
			Duration in Hours	Maximum Marks			
				CIA	CEE	Total	
	Semester I						
I	Language - I	6	3	50	50	100	4
II	English - I	6	3	50	50	100	4
III	Core Paper I – General Chemistry - I	7	3	50	50	100	4
III	Core Practical I (Inorganic Qualitative Analysis)	3	3	-	-	-	-
III	Allied A: Paper I[#] (or)	6	3	50	50	100	4
	Allied A: Paper I[@]	4	3	30	45	75	3
III	Allied A: Practical[@]	2	-	-	-	-	-
IV	Environmental Studies*	2	3	-	50	50	2
	Total	**30**		**180**	**245**	**425**	**17**
	Semester II						
I	Language – II	6	3	50	50	100	4
II	English – II	6	3	50	50	100	4
III	Core Paper II – General Chemistry - II	7	3	50	50	100	4
III	Core Practical I (Inorganic Qualitative Analysis)	3	3	50	50	100	4
III	Allied A: Paper II[#] (or)	6	3	50	50	100	4
	Allied A: Paper II[@]	4	3	30	45	75	3
III	Allied A: Practical[@]	2	3	25	25	50	2
IV	Value Education – Human Rights*	2	3	-	50	50	2
	Total	**30**		**255**	**320**	**575**	**23**
	Semester III						
I	Language – III	6	3	50	50	100	4
II	English – III	6	3	50	50	100	4
III	Core Paper III – Inorganic Chemistry - I	3	3	50	50	100	4
III	Core Paper IV – Physical Chemistry - I	3	3	50	50	100	4
III	Allied B: Paper I[#] (or)	6	3	50	50	100	4
	Allied B: Paper I[@]	4	3	30	45	75	3
III	Core Practical II (Volumetric and Organic Analysis)	2	-	-	-	-	-
III	Allied B: Practical[@]	2	-	-	-	-	-
IV	Skill based Subject 1: Chemistry of Natural and Synthetic Fibers	2	3	30	45	75	3
IV	Tamil** / Advanced Tamil* (OR) Non-major elective - I (Yoga for Human Excellence)* / Women's Rights*	2	3	-	50	50	2
	Total	**30**		**260**	**340**	**600**	**24**

	Semester IV						
I	Language – IV	6	3	50	50	100	4
II	English – IV	6	3	50	50	100	4
III	Core Paper V – Organic Chemistry - I	4	3	50	50	100	4
III	Core Practical II (Volumetric and Organic Analysis)	3	6	50	50	100	4
III	Allied B: Paper II[#]	6	3	50	50	100	4
	Allied B: Paper II[@]	4	3	30	45	75	3
III	Allied B: Practical[@]	2	3	25	25	50	2
IV	Skill based Subject 2: Technology of Dyeing of Natural Fibers	3	3	30	45	75	3
IV	Tamil**/Advanced Tamil* (OR) Non-major elective -II (General Awareness*)	2	3	-	50	50	2
	Total	**30**		**285**	**365**	**650**	**26**
	Semester V						
III	Core Paper VI (Inorganic Chemistry II)	5	3	50	50	100	4
III	Core Paper VII (Spectroscopy)	5	3	50	50	100	4
III	Core Paper VIII (Electrochemistry)	5	3	50	50	100	4
III	Core Paper IX (Analytical Chemistry)	4	3	50	50	100	4
III	Core Practical III (Gravimetric And Physical)	4	-	-	-	-	-
III	Elective I	4	3	50	50	100	4
IV	Skill based Subject 3: Water & Effluent Treatment And Pollution Control	3	3	30	45	75	3
	Total	**30**		**280**	**295**	**575**	**23**
	Semester VI						
III	Core Paper X (Organic Chemistry II)	5	3	50	50	100	4
III	Core Paper XI (Physical Chemistry II)	5	3	50	50	100	4
III	Core Practical III (Gravimetric And Physical)	7	7	50	50	100	4
III	Elective II	4	3	30	45	75	3
III	Elective III	4	3	30	45	75	3
III	Core Practical for Elective Subjects	3	3	50	50	100	4
IV	Skill Based Subject 4: (Textile Chemistry Practical)	2	3	30	45	75	3
V	Extension Activities**	-	-	50	-	50	2
	Total	**30**		**340**	**335**	**675**	**27**
	Grand Total	**180**		**1600**	**1900**	**3500**	**140**

Note

[#] For subjects without practical.

[@] For subjects with practical.

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

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

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:

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

1. Periodic table-Introduction-Periodic properties- Ionisation energy, Electron affinity, Electronegativity and their variations along the period and groups.
2. Hybridization and geometry of $BeCl_2$, BF_3, CH_4, PCl_5, IF_7 and SF_6. VSEPR Theory. Covalent Bond-Molecular orbital theory-application to molecules such as H_2^+ He_2, F_2, O_2, N_2, CO and NO.

Unit:2	Reaction of Alkenes and Alkynes	21 hours

1. Nomenclature of acyclic alkane, alkene and alkyne.
2. Alkenes: Preparation by Wittig reaction – Mechanisms of beta elimination – E1, E2 and cis elimination – Hoffmann's rule and Saytzeff's rule. Addition reactions with hydrogen, halogen, hydrogen halide (Markownikoff's rule) and hydrogen bromide (Peroxide effect). Dienes: Stability of isolated and conjugated dienes-1, 2 and 1, 4 additions, Diels -Alder reaction. Free Radical addition – Polymerization – synthetic rubber.
3. Alkynes: Acidity of Alkynes – formation of acetylides-addition of water with $HgSO_4$ catalyst-hydroboration.

Unit:3	Polar Effects and Conformations of Alkanes	21 hours

1. Polar effects – inductive effect, mesomeric effect, electromeric effect, hyper conjugation and steric effects. Classification of reagents: Electrophiles, Nucleophiles and Free radicals. Types of reaction: Polar reactions involving carbonium ions and carbanions with simple examples.
2. Aliphatic Hydrocarbons: Restricted rotation about single bond preferred rotational conformations.
3. Cycloalkanes: Preparation by Dieckmann ring closure and by reduction of aromatic hydrocarbons – ring opening reactions of cyclopropane with H_2, Br_2 and HI.

Unit:4	Liquid Crystals and Black Body Radiation	21 hours
1. Liquid crystals–the concept of mesomorphic state-typical liquid crystalline substances and their properties. 2. Failure of classical theory in explaining black body radiation- Planck's theory of quantization of energy – Einstein's theory of photoelectric effect-Compton effect. de-Broglie theory of wave-particle dualism. Particle in one dimensional box (Wave length determination only) - Schrodinger equation.		
Unit:5	**Laws of Thermodynamics**	**21 hours**
The laws of thermodynamics, generalities and Zeroth law – kinds of energy – Scope of the first and second laws of thermodynamics-thermodynamic terms-definitions – heat – work of expansion – work of compression – maximum and minimum quantities of work – Reversible and irreversible transformations of energy. First law of thermodynamics – properties of energy changes in relation to properties of system- isothermal and adiabatic changes – meaning of the thermodynamic state function – properties of exact and inexact differentials – Joule Thomson experiment.		
	Total Lecture hours	**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:

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

1.Principles of Volumetric Analysis: Terms used in volumetric analysis, primary and secondary standard substances, standardization of solutions.

2. Concentration units: ppm, molality, formality, molarity, mole fraction, normality, weight percent and volume percent. Determination of equivalent weight of acids, bases, oxidant, reductant and simple salts. Types of volumetric titrations, acid-base, redox, precipitation and complexometric titrations.

3. Indicators: Effect of change in pH, neutralization, redox, adsorption and metal ion indicators.

4. Oxidation and reduction reactions: balancing redox equations by oxidation number and ion-electron method.

Unit:2	Boron and Silicates	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-Aromaticty-Huckel'srule. 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, Bravis lattice, unit cell, law of rational indices (Weiss indices), Miller indices, Symmetry elements in crystals (for cubic system only). X-ray diffraction by crystals - derivation of Bragg's equation - Bragg method - powder method. Crystal structure of NaCl, Wurzite, CaF_2 and TiO_2- radius ratio rules and packing in crystals.		
	Total Lecture hours	**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, ArunBahl, 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:

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=oz1LNl90SSU
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	Outline the importance of solvents and solubility in chemical reactions	**K2**
4	Define and classify the structure and properties of organometallic compounds	**K1-K3**
5	Describe the structure & functioning of biomolecules and role of metals in biology	**K1,K2**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Methods of Extraction**	**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_2O_5, $ZrOCl_2$, $(NH_4)_2MoO_4$, WO_2, and tungsten bronzes.

Unit:3	**Role of Solvents**	**9 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_2H_5OH and Ether.

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_nH_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 – Metallo-enzymes: Carbonic anhydrase, Carboxy peptidase.		
	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 and Dr. P. Rajesh

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:

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. Phathania, S.Chand& Company
2	Physical chemistry G,W.Castelan, Narosa Publishers.
3	Physical chemistry (Vol.ll) – N.B.Singh, ShivasaranDas, 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, 46thEdn. 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. P. Rajesh	

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". *Man-Made Textiles in India*. 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). *Cotton: The Biography of a Revolutionary Fiber*. Penguin (Non-Classics), 16. ISBN 0-14-303722-6.
2	Kadolph, Sara J., ed.: *Textiles*, 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. N. Sivakumar	

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

Fourth Semester

Course code	43A	ORGANIC CHEMISTRY - I	L	T	P	C
CORE		Core VI – Paper V	4	-	-	4
Pre-requisite		Basics of Organic Chemistry	Syllabus Version		2020-2021	

Course Objectives:

The main objectives of this course are to:

1. Understand the carbonyl compound's reactivity and various reduction reactions
2. Explain the reactivity of active methylene compounds with electrophiles
3. Outline the reactivity of monohydric 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, Knoevanagel 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, Arunbahl, 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:

1. Inculcate the students how to skilfully handle the laboratory equipments, reagents, lab apparatus and preparation of standard solutions.
2. Impart the first-hand knowledge and experience on estimation of an ion, acid and base both directly as well as indirectly.
3. Provide the student knowledge on analysis of an unknown organic substance using Preliminary and confirmation test and prepare a suitable derivative.
4. 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_2C0_3

B. Permanganometry:

1. Estimation of Ferrous sulphate & Oxalic acid
2. Estimation of Calcium-Direct method.

C. Dichrometry: Estimation of Ferrous iron using internal indicator.

D. Iodimetry:

1. Estimation of $K_2Cr_2O_7$
2. Estimation of Copper.
3. Estimation of As_2O_3.

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		Basic 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 dying textile industry.
2. To help students to acquire additional knowledge of dyeing auxiliaries and methods used in textile industry.
3. To give students an over view on process and mechanism of dyeing.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	State the basic aspects of colour and dyeing auxiliaries.	**K2,K4,**
2	Outline various methods of dyeing.	**K2,K3**
3	Demonstrate the process of azoic dyes and their applications.	**K2,K3**
4	Acquire knowledge in vat dyes and the procedures followed for dyeing.	**K2,K3**
5	Summarize the properties and mechanism of dyeing particularly sulfur and acid dyes.	**K3,K4, K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Introduction to Dyeing**	**6 hours**

Theory of Colour, chromophore, auxochrome, chromogen. Primary and Secondary colour. Chromatic and Achromatic Colours – Classification of dyes. Definition – Affinity, Substantivity, Exhaustion, % Shade, Adsorption, Diffusion, Aggregation, Migration – Effects of M:L ratio, salt, time and temp. of dyeing. Properties of direct dyes – Application of direct dyes of Cotton: Mechanism of dyeing. Stripping and Redyeing. After treatment with $CuSO_4$, $K_2Cr_2O_7$ and dye fixing agents.

Unit:2	**Methods of Dyeing**	**6 hours**

Reactive dyes – properties, Cold Brand, Hot Brand, Vinyl sulphone dyes, LS dyes, HE dyes, bifuctional dyes, Mechanism of dyeing. Exhaust dyeing, pad-batch, pad-steam, pad-cure, pad-silicate Methods. Stripping and redyeing.

Unit:3	**Napthols and Fast Bases**	**6 hours**

Naphthols and Fast Bases: properties and application – Diazotisation and coupling. Brief study on dissolution (classification of naphthols, cold and hot dissolution methods). Bases – direct and indirect method of diazotization. Application procedure of any one naphthols and base using Jigger and pad-dry-develop method. Stripping and Redyeing.

Unit:4	**Vat Dyes**	**6 hours**

Types of Vat dyes. Details of vatting, dyeing, oxidation and soaping. Application procedure: Leuco vat, vat acid – pigment padding – pad steam process. Merits and demerits of above methods. Dyeing of yarn with vat dyes by conventional method.

Unit:5	Properties and Application of Dyes	6 hours
Brief study – solubilised vat dyes – properties – advantages and disadvantages over vat dyes – application – exhaust dyeing method. Sulphur dyes – Properties of Sulphur dyes – application. Jigger and continuous dyeing defects. Bronziness and acid tendering – Stripping and redyeing. Use of hydros. Properties of basic dyes mordants used for cotton. Dyeing wool & silk with basic dyes. Eco-friendly sulphur dyeing. Acid dyes – Properties, classification of dyes – leveling acid dyes, milling acid dyes – supermilling acid dyes – application to wool and silk. Mechanism of dyeing – Dyeing of nylon with acid dyes.		
	Total Lecture hours	**30 hours**

	Text Book(s)
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 400 031.
2	Chakravarthy RR and Trivedi S.S., Technology of Bleaching and Dyeing of Textile Fibre Vol 1, Part 1, 1979, Mahajan Book Publi shres, Supermarket Basement, Near Nataraj Cinema, Ashram Road, Ahmedabad 380 009.
3	Srivastava SB, Recent Process of Textile Bleaching, Dyeing and Finishig, 1981, SB Srivastava, S B P Board Consultant, S B P Buildings, 4/45 Roopnagar, Delhi 110 007.
	Reference Books
1	Trotman E.R, Dyeing and Chemical Technology of Textile Fibre, Charles Griffin & Co, 42, Dhury lane, Londan WC2
2	Gokhle S.V. and Shah.R.C., Cotton Piece dyeing, 1981, Ahmedabad Textile Industrial Research Assn. (ATIRA), PO Polytechnic, Ahmedabad 380 015.
3	Prayag R.S., The bleaching and deying of Cotton material 1983, Weaver's Service Cent., 15A, Mamparamanand Marg, Near Roxy Cinema, Bombay 400 004.
4	D.M. Lewis, Wool Dyeing, SDC Publications, UK.
5	J.K.Aspland, Textile Dyeing and Colouration, AATCC Publications, USA.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://onlinecourses.swayam2.ac.in/cec19_te01/preview
2	https://www.classcentral.com/course/swayam-textile-finishing-14326
	Course Designed By: Dr. S. Rajalakshmi

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 various theories of coordination compounds and complete understanding on Crystal Field and Valence Bond Theory.	**K2,K3**

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 istopes – 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 disintergration series.		
Unit:4	**Co-ordination Chemistry - I**	**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 – hybridization, geometry and magnetic properties of $[Ni(CN)_4]^{2-}$, $[NiCl_4]^{2-}$,$[Fe(CN)_6]^{4-}$, $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$.		
Unit:5	**Co-ordination Chemistry - II**	**15 hours**
Limitations of valance bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planner complexes, low spin & high spin complexes, factors affecting the crystal-field parameters. Explanation of colour and magnetic properties using CFT, comparison of VBT and CFT. A brief outline of thermodynamics stability of metal complexes and factors affecting the stability, stability constants of complexes and their determination, substitution reactions of square planar complexes.		
	Total Lecture hours	**75 hours**

Text Book(s)

1	Malik,Wahid U., G.D. Tuli and R.D .Madan . Selected Topics in InorganicChemistry,7th 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, 4th ed., New Age International, New Delhi, 1995.

Reference Books

1	J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry, 4th ed., Harper Collins, New York, 1993.
2	F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6th 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 and Mr. C. Sudhakar

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:

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

Spectroscopy: Absorption and Emission spectra – Fundamental concepts – Electromagnetic spectrum with relative energies in each region.

Ultra Violet – Visible Spectroscopy: Introduction – Beer–Lambert's law – Instrumentation (block diagram) – Formation of absorption bands – Theory – Types of 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.

Unit:2	IR and Raman Spectroscopy	15 hours

IR Spectroscopy: Principle – Types of molecular vibrations – Vibrational frequencies – Factors affecting vibrational frequencies – Instrumentation (block diagrams with description of components) – Finger print region – Characteristic absorption bands of various functional groups – Applications of IR spectra.

Raman Spectra: Theory - Comparison of IR and Raman spectra – Applications of Raman Spectra.

Unit:3	NMR Spectroscopy	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 Edn, 2017.
2	Organic Spectroscopy (Principles and Applications) – Jag Mohan, Narosa Publishing House, Second Edn, 2012.

Reference Books

1	Spectroscopy of Organic compounds – P.S. Kalsi, New Age International Ltd. Publishers, Sixth Edn, 2005.
2	Analytical Chemistry (Theory and Practice) – U.N. Dash, S. Chand & Sons, Second Edition, 2005.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://ndl.iitkgp.ac.in/
2	https://nptel.ac.in/course.html
3	https://ocw.mit.edu/
	https://www.oercommons.org/advanced-search

Course Designed By: Dr. 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, Ka	**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. 33rd edition, 1992.
2	S.H. Maron and J.B. Lando, Fundamentals of physical chemistry, Macmillan limited, New York, 1966.
Reference Books	
1	S.K. Dogra and S. Dogra, Physical chemistry through problems, New age international, 4th edition 1996.
2	P.W. Atkins, Physical chemistry, Oxford university press, 1978
3	K. L. Kapoor, A textbook of Physical chemistry, (volume-2 and 3) Macmillan, India Ltd, 1994.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://chem.pg.edu.pl/documents/175289/4235721/Electrochemistry-supplement%20text.pdf
2	https://nptel.ac.in/courses/104/106/104106105/
3	https://nptel.ac.in/content/storage2/courses/103108100/module6/module6.pdf
Course Designed By: Dr. 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:

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.
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/uplode/book/book-19965.pdf
2	https://chem.libretexts.org/Courses/University_of_California_Davis/UCD_Chem_105/Chapters/5._Errors_in_chemical_analysis
Course Designed By: Dr. S. P. Rajasingh and Dr. S. Sivakumar	

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:

1. Over view of impact of man on the environment
2. Detail view of pollutions and water softening techniques
3. Description about water effluent treatment and pollution analysis techniques

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	To understand urbanization and biodiversity along with environmental pollution.	**K1, K2**
2	Acquires the knowledge about water pollution and water softening methods.	**K1,K2, K3, K4**
3	Importance about water analysing methods along with determination of BOD, COD and toxicity.	**K2,K3, K4,**
4	Detail explanation of primary, secondary and tertiary water treatment methods.	**K2,K3, K4,K5**
5	Discuss about effect of noise pollution along with brief study on modern methods for pollution analysis.	**K1,K2, K4**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**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 di oxide and silica.

Unit:3	Analysis Techniques for Water	6 hours
Removal of colour and turbitity (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 + Magnessium). EDTA Titrimetric method, total iron- thiocyanate method, Determenation of Alkalinity by Titrimetric method – thiocyanate method, Determination of Alkalinity by Titrimetric method- Datermination 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 – Tricking 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. Manivaskam, 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 and Dr. S. Rajalakshmi

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:

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
Terpenoids: Introduction – Classification – General methods of isolation – Isoprene rule-structural elucidation and synthesis of Geraniol, Terpineol and dipentene. **Vitamins**: Introduction – Importance of vitamins – Structural elucidation and synthesis of Retinol, Riboflavin and Ascorbic acid.		
Unit:5	**Alkaloids and Hormones**	**15 hours**
Alkaloids: Introduction – Classification and General Characteristics – General methods of determining structures – Hoffmann's exhaustive methylation – Structural elucidation and synthesis of Nicotine, Piperine and Papaverin. **Harmones**: Introduction – Structural elucidation and synthesis of Adrenaline and Thyroxine.		
	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 Edn., 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 dipolemoment 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
Experimental techniques involved in following kinetics of reaction. Volumetry, manometry, polarimetry and colorimetry, typical examples for each of the techniques. Theoretical aspects. Effect of temperature on rate constant. The activation energy. The collision theory of reaction rates and its limitation. Lindemann theory of unimolecular reactions. The theory of Absolute reaction rates. Comparison of the collision theory with the Absolute reaction rate theory.		
Unit:5	**Photochemical Reactions**	**15 hours**
Thermal chain reaction H_2/Br_2 reaction.Kinetics of photochemical reactions. Absorption of light and photochemical process. The Stark-Einstein law of photochemical equivalence. Photochemical chain reaction H_2/Br_2 reaction. Quantum yield of photochemical ractions. Comparison of thermal & photochemical kinetics of H_2/Br_2 reaction. Photosensitized reactions. Fluoresence, phosphorescence and chemiluminesence.		
	Total Lecture hours	**75 hours**

Text Book(s)	
1	Principles of Physical Chemistry, B.R.Puri, L.R.Sharma and M.S.Phathania, Shobanlal Nagin Chand & Co
2	Essentials of Physical Chemistry, B.S.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/mode/2up
2	https://nptel.ac.in/content/storage2/courses/122101001/downloads/lec-26.pdf
3	https://www.youtube.com/watch?v=W8FhlGNnMkg&t=5447s
Course Designed By: Dr. T. Selvaraju	

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:

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

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

1. Estimation of Sulphate as Barium Sulphate
2. Estimation of Calcium as Calcium Oxalate.

Part III	Conductometric Physical Experiments	45 hours

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

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 Experments	60 hours
1. Determination of Kf / 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=2VzEpsEZOYo (Rast's Macro Method)
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	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 SUSBJECTS	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:

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**
(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. (a) Extimation of Fe^{3+} with Ammonium thiocyanate. (b) Extimation 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. K. Velumani	

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

Skill Based Subject

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:

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

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

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 *Analysis*, B.K Sharma, 2014
3	The Complete Technology Book on Dyes & Dye Intermediates by National Institute of Industrial Research, 2004

Reference Books

1	Handbook of Water Analysis, 3rd Edition by Nollet, Taylor and Francis, 2013.
2	Vogel's text book of quantitative Chemical *Analysis*, Sixth edition- J Mendham, R C Denney, J D Barnes, M J K Thomas, Pearson Eduction Publshers, 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 Courses

Course code	5EA	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:

1. To understand the types, nature and the various methods of preparation polymers.
2. To learn about the different types of polymerisation reaction mechanism, bonding and properties of polymers.
3. To study the molecular weight determination methods, preparation and properties of commercially important polymers.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Classify Polymers based on their origin, mechanism of formation, citing example. Understand the methods of preparation process and apply the - correct method of preparation for a particular polymer.	**K1-K3**
2	Analyze the reaction mechanisms of polymerization.	**K1,K4**
3	Understand the relation between the bond forces and structural properties of polymers.	**K2,K4**
4	Understand the principles behind the molecular determination methods and applying them to calculate the different molecular weights of polymers.	**K2,K4**
5	Explain the basic preparation methods and have a good knowledge on the Industrial Applications of Polymers.	**K2,K3**

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Classification and Preparation of Polymers	12 hours

1. Classification Of Polymers-Natural Polymers And Synthetic Polymers. Synthetic Polymers-Addition Polymers, Condensation Polymers.
2. Methods Of Preparation Of Polymers-Bulk, Solution ,Suspension And Emulsion

Unit:2	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 5. End Group Analysis.
Weight Average Molecular Weight Methods.
1. Light scattering 2. Ultra centrifugation
Molecular weight distribution.

Unit:5	Industrial Polymers	12 hours

Important industrial polymers, preparation and applications of
i) Polyethylene, polypropylene ii) Polyamides iii) Polyvinyl chloride and polymethylmethacrylate
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:

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 & 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 CO2, 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, AI, 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**

Text Book(s)

1	Soil Chemistry – Shivanand Tolanur, CBS Publishers & Distributors 2nd Edition, 2018.
	Insecticides, Pesticides and Agro based Industries – R.C.Palful, K.Goel, R.K.Gupta
2	Industrial Chemistry-B.N Chakrabarty, Oxford & IBH Publishing Co, New Delhi,1981
3	Industrial Chemistry-B.K.Sharma, GOEL Publishing House, 2000

Reference Book

1	Nature and properties of soils - Nyle C.Brandy, Ray R.Weil, Pearson Education India; 14th Edition, 2013.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.cdc.gov/healthywater/other/agricultural/index.html
2	http://nmsp.cals.cornell.edu/publications/NMSPLabManual2017.pdf
3	https://www.youtube.com/watch?v=R9J7pOU5FSg
4	https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/2017/Oils-Fats-Waxes-Notes.pdf

Course Designed By: Dr. S. P. Rajasingh and Dr. M. Sivakumar

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:

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**

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, antagoinism, 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, diabetis, tuberclosis, 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 pshycogeneic), classification – morphine and its derivatives. Synthesis assay and uses of pethidine and methadone-antipyretic analgesics-salicylic acid derivatives-paracetamol, phenacetin-propanoic acid derivative-Ibuprofen.
3. Antibiotics: definition –microbial synthesis structure, assay and uses of chloramphenicol and pencilin-structure and use of streptomycin and tetracyclines.
4. Sulphanonamides: Definition-mechanism of action-classification-SAR- synthesis and use of sulpha acetamide, sulpnathiazole, 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 surfacts and chloro compounds. Tranquilizers-definition and examples. Psychodelic drugs LSD and marijuana.
2. Anaesthetics – Definition –Classification –volatile anaesthetics (N_2O, 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 harmones, 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 Al_2P_2As, Hg and Fe. Uses of the following $MgSO_4$ $7H_2O$, milk of magnesia, magnesium trisilicate-Aluminium hydroxide gel, dihydroxy aluminium amino acetate, Aluminium acetate and aluminium monostearate-paroxon-phosphorine, cyclophosphosphomide-tricyclophos-preparation and use of thiotepa-sodium and copper cacodylates-preparation and uses of aromatic aresericals (carbosone, triparasomide, acetarsonide, neoarsphenamine, oxophenarisince)- $HgCl_2$, Hgl_2 and $Hg(CN)_2$ as disinfectations-importance of organic mercury compounds-structure and uses of thiomersal, netromersal merbromine and mersalyl acid-Ferous gluconate, $FeSO_4$, 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-sequeshants, colouring, sweetening, flavouring, emulsifying and stabilizing agents.
3. AIDS-cause HIV-prepagation-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 - antiarrythmic drugs - antihypertensive drugs-antianginal agents-vasodilators-lipid lowering agents-sclerosing agents		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	Pharmaceutical Chemistry by S. Lakshmi, Sultan Chand & Sons, 2nd ed (1998).
2	Pharmacolgy and pharmatherapeutics, Vol.1 & 2, R.S. Satoskar and S.D. Bhandarkar 11th Ed, Popular prakashan, Mumbai, 1989.
3	Bentleys, Text book of pharmacutics, 8th Ed. E.A. Raubins, 1992, All India traveler book sellers, Delhi.
4	Medicinal Chemistry, Ashutosh kar, New Age International, 1992.
5	A text book of pharmaceutical chemistry, Jayashree ghosh, S. Chand, 1997.
Reference Book(s)	
1	From molecules to medicines-J.L.Sussman, P. Spadon, Springer; 2009th edition.
2	Organic medicinal and pharmaceutical chemistry-J.M. Beale, J.H. Block, Wolters Kluwer India Pvt. Ltd.; 12th edition 2010.
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

Course Designed By: Dr. M. Asaithambi

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:

1. To understand the basics of skins, leather and their composition.
2. Impart the principle involved in pre-tanning and structure and process of various tannings
3. Inculcate the methods of curing hides and skins and process of dyeing leather
4. Knowledge on the water pollution by tannery industry and it's effluent treatment

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the structure and composition of hides and skins and principle involved in pre-tanning	**K1-K3**
2	Have knowledge on various types of tanning and their physic-chemical properties	**K2, K3**
3	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**

1. Hides, Skins,Leather-An elementary knowledge of the structure and composition of hides and skins. Proteins and their characteristics, Anatomy and histology of protein constituents of leather (an elementary concept).

2. Basic principle involved in pre-tanning such as soaking, liming, deliming, bating , pickling involved in pre-tanning such as soaking, liming, deliming, bating, pickling and depickling.

Unit:2	**Types of Natural and Synthetic Tannings**	**12 hours**

1. Types of tanning-vegetable and mineral tanning, Different types of vegetable tanning-materials classification and chemistry of vegetable tanning. Factros and Physio-chemical principle involved in vegetable tanning, Fixation of vegetable tanning.

2. Synthetic tannings-their classifications, general methods of manufacture and use.

Unit:3	**Chemistry of Chrome Tanning**	**12 hours**

1. The preparation and chemistry of chrome tanning liquids, Olation, Oxolation and hydrolysis of chrome liquids. Effect of adding tanning agents-Role of pH in the reaction of chromium complexes with hide proteins. Factors governing chrome tanning-chemistry of neutralization process. A brief survey of chemistry of other tanning like Al, Zr and Te salts and their relative merit in contrast with chrome tanning 2. Chemistry of combination of tannages involving vegetable tanning aldehydes, chrome and other mineral tanning agents.

Unit:4	Preservation of Hides and Skins and Leather Dyeing	12 hours
1. Chemical methods of curing and preservation of hides and skins in acid and alkaline solution. 2. Principles of analytical methods employed in curing, liming, deliming, bating, pickling. Analysis of vegetable tanning materials and extract. 3. Process of dyeing leather-Use of mordants, dyeing auxillaries such as leveling, wetting and dispersing agents-Dye fixations.		
Unit:5	**Source and Treatment of Tannery Effluents**	**12 hours**
1. Animal bye-products-their collection, handing and preservation methods (such as hair, blood, bones, glands, Kerationus materials and their utilization). 2. Tannery effluents and treatment: Types of water pollution-phsical, chemical, physiological and biological. Different types of tannery effluents and wastes-beam-house waste-liquors-tanning and finishing yard waste liquors, solid waste-origin and disposal.		
	Total Lecture hours	**60 hours**

Reference Book(s)

1	Tanning Chemistry: The Science of Leather-A.D. Covington, W.R.Wise, Royal Society of Chemistry, 2019.
2	Tanning processes- A.C. Orthmann, Read Books Publishers, 2011.
3	The Chemistry of Leather manufacture- G.D.Mclaughlin, Read Books, 2011.
4	Vegetable tanning materials- F.N. Howes, Butterworths Scientific Publications, 2007.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://blog.walnutstudiolo.com/2019/04/25/kinds-of-leather-by-tanning-process-veg-tan-vs-chrome-tan/
2	https://www.lowimpact.org/lowimpact-topic/skins-hides/
3	https://envibrary.com/wastes-from-tannery-industries/

Course Designed By: Mr. C. Sudhakar

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 piper 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**

Text Book(s)	
1	Fundamentals of Biochemistry-J.L.Jain, S.Jain, N.Jain, S Chand; Seventh edition, 2016.
2	Cellulose Derivatives: Synthesis, Structure, and Properties – T. Heinze, O.A.El Seoud, A. Koschella, Springer International Publishing, 2018.
Reference Book(s)	
1	Starch: Chemistry and Technology-J.N. BeMiller, R. L. Whistler, Academic Press; 3rd edition, 2009.
2	Cellulose chemistry and its application-T.P.Nevell, Halsted Press, 1985.
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. M. Sivakumar and Mr. C. Shudhakar	

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:

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	Synthetic Dyes – G.R. Chatwal, Himalaya Publishing House, 2009.
2	The chemistry of synthetic dyes Vol, I, II, III & IV - K.Venkataraman, Academic Press N.Y., 1949.
3	The Hand book of Synthetic Dyes and Pigments – K.M. Shah, Publisher Edutech, 2013.
Reference Books	
1	The chemistry of synthetic dyes and pigments - H.A. Lubs, New York, Hafner Pub. Co., 1965.
2	Organic chemistry Vol.I - I.L.Finar, Pearson India, 6th edition, 2012.
3	Dyes and Pigments: New Research – A.R. Lang, Nova Science Publishers, Inc.; UK ed. Edition, 2013.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/116/104/116104046/
2	https://www.internetchemistry.com/chemistry/dye-chemistry.php
Course Designed By: Dr. S. 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:

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 compouds	**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) Caffine 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**
Text Book(s)		
1	Vogel's Text Book of Quantitative Chemical Analysis – J. Mendham, RC Denney, JD Barnes, M. Thomas, B. Sivasankar, Pearson Publishers 6th edition 2009.	
Reference Book(s)		
1	Physical methods for chemistry-R.S.Drago, W B Saunders Co Ltd; 2nd Revised edition, 1992.	
2	Spectroscopy in Inorganic chemistry-C.N.R Rao and JR Ferraro Academic Press Inc, 1971.	
3	Fundamentals of Analytical Chemistry - D.A.Skoog, D.M.West, S. Jose, F.J.Holler Cengage Learning, 2004	
4	Instrumental methods of Chemical Analysis-B.K. Sharma Krishna Prakashan Media (P) Ltd. 2014.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.youtube.com/watch?v=Zp-BHsdqsRw	
2	https://nptel.ac.in/courses/104/106/104106122/	
3	https://www.slideshare.net/SihamAbdallaha/electrochemical-method-of-analysis-31352857	
4	https://gtu.ge/Agro-Lib/Vogels_TEXTBOOK_OF_QUANTITATIVE_CHEMICAL_ANALYSIS_5th_ed__-_G_H_Jeffery.MsuCity.pdf	
Course Designed By: Dr. M. Sivakumar and Dr. A. Thirumoorthi		

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:

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., Fundamantal 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. T. Selvaraju and Mr. 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 –Fastnerss properties of dyed materials – dyeing of nylon, terylene and other synthetics. 2. Finishes given to fabrics- Mechanical finishes on cotton, wool and silk, method used process of mercerizing –Anti-crease and Anti-shrink finishes –Water proofing.		
	Total Lecture hours	**60 hours**

Text Books(s)	
1	Text Book of Applied Chemistry-M.A.Islam, Sonali Publications; 1st edition, 2011.
2	Chemistry of dyes & Principles of Dyeing -V.A.Shenai, Sevak Publications, 1983.
Reference Book(s)	
1	The Identification of Textile Fibres – Bruno Luniak, Isaac Pitman & Sons, Limited, 1953.
2	Dyeing and chemical Technology of Textile fibres-5th Edition, E.R.Trotman, Charles Griffin & Co Ltd, 1970. (Digitalized 2010).
3	Chemical Technology of fibrous Materials – F.I. Sadov, M.V. Horchagin and A.Matetsky, Mir Publishers, 1978. (Digitalized 2008).
4	Textile Scouring and Bleaching E.R.Trotman, Charles Griffin & Co Ltd.1968.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://blogionik.org/blog/2017/04/02/natural-synthetic-fiber/
2	https://www.assignmentpoint.com/science/textile/textile-fiber.html
Course Designed By: Dr. S. 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

Annexure

B. Sc. CHEMISTRY

Syllabus
(2021-2022)

Program Code: 22D

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)

MISSION

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