

Semester IV							
420TA4/ 419MY4/ 419HD4/ 419FR4	Part I: Language IV	6	3	25	75	100	4
419EN4	Part II: English IV	6	3	25	75	100	4
420C04	Part III: Core IV General Chemistry IV	4	3	25	75	100	4
420CP2	Part III: Core Practical II Volumetric and Organic Analysis	3	6	40	60	100	3
417AC4	Part III: Allied IV Mathematics II	6	3	25	75	100	4
420CS2	Part IV: Skill Enhancement Course II: IT Skill for Chemists	3	3	75	-	75	3
417NGA	Part IV: General Awareness and Information Security	2	2	50	-	50	2
420CA1	Advanced Learner's Course I – Food Science	-	-	-	100	100*	4*
Semester V							
517C05	Part III: Core V Organic Chemistry I	5	3	25	75	100	4
517C06	Part III: Core VI Inorganic Chemistry I	4	3	25	75	100	4
517C07	Part III: Core VII Physical Chemistry I	4	3	25	75	100	4
517CE1/ 517CE2	Part III: Elective I Polymer and Dye Chemistry / Agro-Industrial Chemistry	4	3	25	75	100	4
517CE3	Part III: Elective II Project	4	3	25	75	100	4
	Part III: Core Practical III Gravimetric Analysis and Physical Chemistry experiments	4	-	-	-	-	-
	Part III: Core Practical IV Applied Chemistry Practical	2	-	-	-	-	-
517CS3	Part IV: Skill Enhancement Course III: Chemistry for Exploration II	3	3	75	-	75	3
Semester VI							
617C08	Part III: Core VIII Organic Chemistry II	5	3	25	75	100	5
617C09	Part III: Core IX Inorganic Chemistry II	4	3	25	75	100	4
617C10	Part III: Core X Physical Chemistry II	4	3	25	75	100	4
617C11	Part III: Core XI Spectroscopy	4	3	25	75	100	4
617CE4/ 617CE5	Part III: Elective III Industrial Chemistry/ Applied Chemistry	4	3	25	75	100	4
617CP3	Part III: Core Practical III Gravimetric Analysis and Physical Chemistry Experiments	4	6	40	60	100	4
617CP4	Part III: Core Practical IV Applied Chemistry Practical	2	3	25	50	75	2
617CS4	Part IV: Skill Enhancement Course IV: Nanoscience	3	3	75	-	75	3
617EX1/ 617EX2/ 617EX3 617EX4/ 617EX5	Part V: Extension activity	-	-	50	-	50	2
617ALC	Advanced Learner's Course II - Dairy Chemistry	-	3	-	100	100	4*

		Total	180				3500	140
Employability,	Entrepreneurship,	Skill development						

Programme Education Objectives

PEO 1: To provide a basic knowledge of various chemical phenomena including the recent developments and applications in Chemistry.

PEO 2: To impart knowledge in laboratory skills and safety lab practices.

PEO 3: To develop effective oral and written communication skills.

PEO 4: To implement the scientific method and critical thinking to solve chemical problems.

PEO 5: To incorporate social, ethical, environmental and economical considerations and responsibilities.

PEO 6: To develop a thirst for higher education & research and to train students to become employable / entrepreneurs.

Mapping of College Mission to Programme Educational Objectives

College mission	PEOs
1. To create a benchmark in the field of education through various disciplines of study.	1,2,3,4,5,6
2. To provide a learner centric curriculum for life and living.	1,2,3,4,5,6
3. To equip the students face the challenges of the dynamic environment by providing necessary skills.	1,2,3,4,5,6
4. To offer value based education synthesizing Arts, Science and Spirituality.	3,5,6
5. To train the students for selfless service and nation building activities.	5,6

Mapping of Department Mission to Programme Educational Objectives

Department mission	PEOs
1. To impart quality chemistry education by offering sound knowledge in theoretical, practical and technical chemistry.	1,2,3,4
2. To develop innovative instructional techniques for lecture and laboratory courses.	1,2,3,4
3. To foster a desire for higher education and research.	1,2,3,4,6
4. To instill social responsibilities through extension activities and value education and to communicate the excitement of chemistry to the public at large.	3,5,6
5. Enabling the students to emerge as job holders or entrepreneurs.	1,2,3,4,6

Programme Outcome

The completion of the programme will provide

PO 1: An understanding of major concepts, theoretical principles and experimental findings and the ability to employ them for critical thinking and efficient problem solving skills in the basic areas of chemistry .
PO 2: An ability to work with modern instrumentation, classical techniques, conduct experiments, analyze data, and interpret results effectively in diverse teams both in classroom and laboratory.
PO 3: Social values, environmental consciousness, effective written and oral communication skills, especially the ability to communicate complex technical information in a clear and concise manner.
PO 4: A familiarity and applications of safety and chemical hygiene regulations and practices.
PO 5: An ability to gain entry into higher studies and job market with the knowledge of chemistry and other associated multidisciplinary subjects including physics and mathematics.
PO 6: Fundamental foundations through activities such as subject interactions and internships.

Programme Specific Outcomes (PSOs)

At the end of the program, the students will be

PSO 1: Eligible for Higher Studies, Employability, Entrepreneurship and Research.
PSO 2: Skillful in chemical analysis .
PSO 3: Competent for applying TNPSC, UPSC and other recruitment board examinations for which under graduation is the basic qualification.

Mapping of Programme Outcome to Programme Educational Objectives

	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
PO 1	H	H	M	H	M	M
PO 2	H	H	M	H	M	M
PO 3	M	M	H	M	H	M
PO 4	M	H	L	M	M	M
PO 5	M	M	M	H	H	H
PO 6	M	H	M	M	M	H

Curriculum design
Sri G. V. G. Visalakshi College for Women (Autonomous)
 Affiliated to Bharathiar University
Department of Chemistry
B.Sc Chemistry

Scheme of Examination – CBCS Pattern
 (For the students admitted from the academic year 2017 – 2018 onwards)

Sem	Course Code	Course Title	Ins. Hrs / week	Examination			Credits	
				Dur. Hrs	CIA Marks	ESE Marks		Total Marks
I	117TA1/ 117MY1/ 117HD1/ 117FR1	Part I: Language I	6	3	25	75	100	4
	117EN1	Part II: English I	6	3	25	75	100	4
	117C01	Part III: Core I General Chemistry I	7	3	25	75	100	4
		Part III: Core Practical I Semi-micro Qualitative Analysis	3	-	-	-	-	-
	117AC1	Part III: Allied I Physics I	4	3	25	50	75	3
		Part III: Allied Physics Practical	2	-	-	-	-	-
	117EVS	Part IV: Environmental Studies	2	2	50	-	50	2
II	217TA2/ 217MY2/ 217HD2/ 217FR2	Part I: Language II	6	3	25	75	100	4
	217EN2	Part II: English II	6	3	25	75	100	4
	217C02	Part III: Core II General Chemistry II	7	3	25	75	100	4
	217CP1	Part III: Core Practical I Semi-micro Qualitative Analysis	3	3	25	50	75	3
	217AC2	Part III: Allied II Physics II	4	3	25	50	75	3
	217ACP	Part III: Allied Physics Practical	2	3	20	30	50	2
	217VEC	Part IV: Value Education	2	2	50	-	50	2
III	317TA3/ 317MY3/ 317HD3/ 317FR3	Part I: Language III	6	3	25	75	100	4
	317EN3	Part II: English III	6	3	25	75	100	4
	317C03	Part III: Core III General Chemistry III	4	3	25	75	100	4
		Part III: Core Practical II Volumetric and Organic Analysis	3	-	-	-	-	-
	317AC3	Part III: Allied III Mathematics I	6	3	25	75	100	4
	317NCE	Part IV: Non Major Elective: Chemistry in Everyday Life	2	2	50	-	50	2
	317CS1	Part IV: Skill Enhancement Course I: Applications of Computer in Chemistry	3	3	75	-	75	3
IV	417TA4/ 417MY4/ 417HD4/	Part I: Language IV	6	3	25	75	100	4

	417FR4								
	417EN4	Part II: English IV	6	3	25	75	100	4	
	417C04	Part III: Core IV General Chemistry IV	4	3	25	75	100	4	
	417CP2	Part III: Core Practical II Volumetric and Organic Analysis	3	6	40	60	100	4	
	417AC4	Part III: Allied IV Mathematics II	6	3	25	75	100	4	
	417NGA	Part IV: General Awareness and Information Security	2	2	50	-	50	2	
	417CS2	Part IV: Skill Enhancement Course II: Chemistry for Exploration I	3	3	75	-	75	3	
	417ALC	Advanced Learner's Course I – Food Science	-	3	-	100	100	4*	
V	517C05	Part III: Core V Organic Chemistry I	5	3	25	75	100	4	
	517C06	Part III: Core VI Inorganic Chemistry I	4	3	25	75	100	4	
	517C07	Part III: Core VII Physical Chemistry I	4	3	25	75	100	4	
	517CE1/517CE2	Part III: Elective I Polymer and Dye Chemistry / Agro-Industrial Chemistry	4	3	25	75	100	4	
	517CE3	Part III: Elective II Project	4	3	25	75	100	4	
		Part III: Core Practical III Gravimetric Analysis and Physical Chemistry Experiments	4	-	-	-	-	-	-
		Part III: Core Practical IV Applied Chemistry Practical	2	-	-	-	-	-	-
	517CS3	Part IV: Skill Enhancement Course III: Chemistry for Exploration II	3	3	75	-	75	3	
VI	617C08	Part III: Core VIII Organic Chemistry II	5	3	25	75	100	5	
	617C09	Part III: Core IX Inorganic Chemistry II	4	3	25	75	100	4	
	617C10	Part III: Core X Physical Chemistry II	4	3	25	75	100	4	
	617C11	Part III: Core XI Spectroscopy	4	3	25	75	100	4	
	617CE4/617CE5	Part III: Elective III Industrial Chemistry/ Applied Chemistry	4	3	25	75	100	4	
	617CP3	Part III: Core Practical III Gravimetric Analysis and Physical Chemistry Experiments	4	6	40	60	100	4	
	617CP4	Part III: Core Practical IV Applied Chemistry Practical	2	3	25	50	75	2	
	617CS4	Part IV: Skill Enhancement Course IV: Nanoscience	3	3	75	-	75	3	
	617EX1/617EX2/617EX3/617EX4/617EX5	Part V: Extension Activity	-	-	50	-	50	2	
	617ALC	Advanced Learner's Course II - Dairy Chemistry	-	3	-	100	100	4*	
		Total					3500	140	

***Starred credits are treated as additional credits (Optional)**

B. Sc Chemistry Semester – I

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core I General Chemistry I	Course Code: 117C01
Semester: I	No. of Credits: 4
No. of hours : 105	C:T 85:20
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T:Tutorial)

Course Objectives:

- To expose the students to laboratory hygiene and safety methods.
- To learn about atomic models, quantum designation of electron, IUPAC periodic table and analyze the periodic properties.
- To study current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters.
- To understand the concept of hybridization, sigma and pi bonds, VSEPR model and predict the geometry of molecules.
- To acquire knowledge about different types of electron displacements, reaction intermediates and organometallic compounds.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Practice safe laboratory practices and management of chemical wastes	A
CO2	Interpret the fundamental assumptions of atomic theory (principles/rules), atomic structure, periodicity of elements in the periodic table and quantum mechanics.	A
CO3	Relate types of chemical bonds and the forces that influence molecular shapes	A
CO4	Predict molecular geometries based on hybridization concept and VSEPR theory	A
CO5	Demonstrate the mechanism of organic reactions, importance of reaction intermediates and organometallic compounds	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Laboratory Hygiene, Safety and Solubility Equilibria (17 Hours)

Storage and handling of chemicals- Toxic and poisonous chemicals- Carcinogenic chemicals- Handling of acids and ethers- Threshold vapour concentration- Waste and fume disposal in the laboratory- General precautions for avoiding accidents- First aid techniques- heating methods, stirring methods and filtration techniques.

Reactions involved in separation and identification of common anions- elimination of interfering anions- group separation- reaction and identification of cations- Solubility product and its application.

Unit II: Atomic Structure and Periodic Properties**(17 Hours)**

Planck's theory of radiation and Einstein's extension- Hydrogen spectrum- Bohr's atomic model- Bohr's theory of hydrogen atom- Bohr- Sommerfeld's atomic model- quantum numbers- Pauli's exclusion principle- wave mechanical concept of atom- Heisenberg uncertainty principle, Hund's rule, sequence of energy levels (Aufbau principle).

Quantum mechanics: Introduction- postulates of quantum mechanics- concepts of operators, Eigen functions, Eigen values- Schrodinger equation- particle in one-dimensional box - derivation for energy.

Modern periodic law and modern periodic table- classification of elements based on electronic configuration (s, p d and f- block elements)- periodicity and properties- atomic radii, ionic radii, covalent radii and van der Waals radii- ionisation energy- factors affecting ionisation energy- electron affinity- factors affecting electron affinity- electronegativity- Pauling and Mulliken electronegativity scale.

Unit III: Chemical Bonding**(16 Hours)**

Types of Bonds- Ionic bonding- Properties of ionic compounds- factors favoring the formation of ionic compounds- ionization potential, electron affinity, and electronegativity- Lattice energy and its determination using Born – Haber cycle- covalent character in ionic compounds- polarization and Fajan's rules- effects of polarization- solubility, melting points and thermal stability of typical ionic compounds.

Covalent Bonding- Lewis theory- types of covalent bond- octet rule and its failure- variable covalency- maximum covalency- characteristics of covalent compounds.

Co-ordinate bonding- illustration with examples- metallic bonding- Band theory of solids- Hydrogen bonding- its types, effects and uses- Van der Waals weak forces- definition, dispersion forces- intermolecular versus intra molecular bonds.

Unit IV: Chemical Bonding - Orbital Concept**(18 Hours)**

VBT- Postulates- types of overlapping: s – s, s – p, p – p overlapping, sigma (H_2 , HF, H_2O and NH_3) and pi (O_2 and N_2) bonding - limitations of VBT- concept of Resonance- resonance energy and requirements- MOT- Basic Principles: LCAO method- criteria of orbital overlap, types of molecular orbitals-s-, p- and d-MOs- combination of atomic orbitals to give s- and p-MOs and their pictorial illustration- MO energy level diagram of homo and hetero diatomic molecules (H_2 , He_2 , O_2 , N_2 , HF, CO) bond order and stability of molecules- Hybridization- rules and types- VSEPR Theory and its limitations- illustration of structures by VSEPR model- NH_3 , SF_4 , ICl_2^- , XeF_4 , XeF_6 .

Unit V: Organic reaction mechanism and Organometallic compounds**(17 Hours)**

Classification- IUPAC nomenclature of organic compounds- Reagents: Electrophiles, nucleophiles, free radicals, Carbanion, Carbocation, Carbene and benzyne -Inductive effect- Electromeric effect- Comparison of Electromeric and Inductive effect- Mesomeric (resonance)

effect - Hyper conjugation and Steric effect (basic concept only) - types of reactions.

Reactions: Nucleophilic substitutions, S_N1 and S_N2 mechanisms, effects of structure, substrate, solvent, nucleophile and leaving groups- Eliminations: E1 and E2 mechanisms, evidences, orientations and stereochemistry.

Organometallic compounds: preparation, properties and uses of organolithium compounds, Grignard reagent.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I	Elements of Analytical Chemistry	R. Gopalan, P. S. Subramanian and K. Rengarajan	S.Chand and Sons publications, 3 rd ed., 2016
II-IV	Principles of Inorganic Chemistry	B. R Puri, L. R Sharma, and K. C Kalia	Milestone publications, 33 rd ed., 2015.
I and II	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma and S. P. Madhan	Vishal publications, 47 th ed., 2015.
V	Modern Organic Chemistry	M. K. Jain and S. C. Sharma	Vishal Publications, 4 th ed., 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Text book of Inorganic Chemistry	P. L. Soni and Mohan Katyal	Chand and sons publications, 20 th ed., 2013.
	Modern Inorganic Chemistry	R. D. Madan	S. Chand and Sons publications, 3 rd ed., 2014.
2.	Mechanism of organic reactions	K. S. Mukherjee	Books and Allied publications, 1 st ed., 2015.

E-Resources : (Web resources & E-books)

- https://learningcenter.nsta.org/products/symposia_seminars/ACS/files/ThePeriodicTableandBonding_1-17-2013.pdf
- <https://ocw.mit.edu/high-school/chemistry/exam-prep/structure-of-matter/chemical-bonding/#Ionic%20Bonds>
- <https://nptel.ac.in/courses/122101001/>
- <http://www.freebookcentre.net/>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's Taxonomy level
CO 1	H	L	M	H	H	M	A
CO 2	H	L	M	H	H	M	A
CO 3	H	L	M	H	H	M	A
CO 4	H	L	M	H	H	M	A
CO 5	H	L	M	H	H	M	A

Content Delivery Methods (Minimum Two):

- Lecture Method
- Demonstration Class

- PPT and Video
- Open Source
- Flip Class

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Group Discussion / Modeling a Concept	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Group Discussion / Modeling a Concept	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Group Discussion / Modeling a Concept (4)
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50%(2 Marks) Presentation :25% (1 Mark)	Presentation: 50%(2 Marks) Content : 25%(1 Mark) Interaction/overall Effort :25% (1 Mark)
U	40%	40%		
A	30%	30%		

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory						
	MCQ																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
I	✓	✓									T	T					T	T				
II			✓	✓								T	T					T	T			
III					✓	✓							T	T				T	T			
IV							✓	✓						T	T					T	T	
V									✓	✓						T	T				T	T

Course Designed by	Dr. J. Bhuvaneshwari
Course Reviewed by	Mrs. M. Malarvizhi
Head of the Department	Mrs. M. Malarvizhi

B.Sc. Chemistry Semester II

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core II General Chemistry II	Course Code: 217C02
Semester: II	No. of Credits: 4
No. of hours : 105	C:T 85:20
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T: Tutorial)

Course Objectives:

- To understand the basic chemistry of aliphatic and aromatic hydrocarbons.
- To understand the scope and potential use of green chemistry in synthetic sequences.
- To learn the principles of titrimetry and their applications.
- To acquire knowledge in acid- base concepts and non aqueous solvents.
- To know the gas laws, properties of real gases and types of molecular velocities.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Interpret the basic chemistry of aliphatic and aromatic hydrocarbons	A
CO2	Employ the potential use of green chemistry in organic synthesis	A
CO3	Apply the principles of titrimetry and the concepts of acid base equilibria and redox equation	A
CO4	Manipulate the concepts in acid- base theory and non aqueous solvents	A
CO5	Analyze the concept of hybridization, behavior of gases and laws associated with them	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Aliphatic Hydro Carbons (18 Hours)

Alkanes- Introduction- Preparation of alkanes: Wurtz reaction, reduction of alkenes, Corey- House method- Reactions: cracking and aromatization.

Alkenes: Introduction- General methods of preparation: dehydrogenation, dehydrohalogenation and dehydration- Hoffmann and Saytzeff rules- Reactions: Mechanism of electrophilic and free radical addition, Markovnikov's rule, peroxide effect, oxidation and ozonolysis- Dienes: Types of dienes (conjugated, isolated and cumulative dienes) - preparation of 1, 3 butadiene- Reactions: Mechanism of 1, 2- and 1, 4-additions and Diels-Alder reactions.

Alkynes: Introduction- Preparation: dehydrohalogenation and dehalogenation- Reactions: formation of acetylides, addition of water, hydrogen halides and halogens, oxidation and ozonolysis- Relative acidity of acetylene, ethylene and ethane

Unit II: Aromatic Hydrocarbons and Green Chemistry (19 Hours)

Aromatic Hydrocarbons: Introduction- Structure of benzene: Kekule's model and

resonance model- Aromaticity: Huckel's rule- preparation of benzene- Electrophilic substitution reactions: nitration, sulphonation, halogenation, Friedel- Crafts alkylation and acylation with mechanism- Friedel- Crafts reaction, Wurtz- Fitting reaction, Clemmensen reduction of ketone, Grignard reagent, cyclisation- orientation effect on di-substitution reactions of benzene- Polynuclear aromatic hydrocarbons: preparation, properties and synthetic uses of naphthalene, anthracene- Structural elucidation of naphthalene.

Green Chemistry: Introduction, purpose and twelve principles of green chemistry- the elementary concept of atom economy- designing a green synthesis: choice of starting materials, reagent, catalyst and solvents. Microwave assisted one pot synthesis of chalcones.

Unit III: Titrimetry (19 Hours)

General principle- Concentration terms: molarity, molality, normality, wt%, ppm and millimole- Primary and secondary standards: criteria for primary standards, preparation of standard solutions, standardization of solutions- limitation of volumetric analysis, endpoint and equivalence point- types of titrations (acid - base and redox titrations only).

Acid-base Equilibria- pH of strong and weak acid solutions- Buffer solutions- Henderson equations- Preparation of acidic and basic buffers - neutralization-titration curve- theory of indicators: choice of indicators- use of phenolphthalein and methyl orange.

Redox equation: oxidation number, oxidation state- rules for calculating oxidation number- definition of oxidation and reduction- oxidizing and reducing agent- auto oxidation - balancing redox equation.

Unit IV: Acids, Bases and Non aqueous Solvents (14 Hours)

Theories of acids and bases: Arrhenius theory- Bronsted-Lowry theory: Conjugate acid base theory, amphoteric nature of water- Lux-Flood- Usanovich theory- Lewis theory: relative strengths of acids and bases- theory of hard and soft acids and bases- HSAB principle and applications in the prediction of hardness and softness and feasibility of the reaction- Non aqueous solvents: classification - general properties of ionizing solvents – chemical reactions of liquid ammonia and liquid SO₂.

Unit V: Gaseous State (15 Hours)

Gaseous state: Kinetic molecular theory of gases- gas laws- Maxwell- Boltzmann distribution of molecular velocities (derivation not necessary)- types of Molecular velocities (derivation not necessary)- Deviation of real gases from ideal behaviour- van der Waal's equation of state- critical phenomena: Andrew's isotherms of carbon dioxide- continuity of state- Relationship between critical constants and van der Waal's constants- Liquefaction of gases: Joule Thomson effect, Linde's method and Claude's method.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I & II	Modern Organic Chemistry	M. K. Jain and S. C. Sharma	Vishal Publications, 4 th ed., 2016

I & II	Advanced Organic Chemistry	Arun Bahl and B. S. Bahl	S. Chand and Sons publications, 3 rd ed., 2014.
III	Elements of Analytical Chemistry	R. Gopalan, P. S. Subramanian and K. Rengarajan	S. Chand and Sons publications, 3 rd ed., 2016.
III & IV	Satya Prakash's Modern Inorganic Chemistry	R. D. Madan	S.Chand and Sons publications, 3 rd ed., 2014.
III & IV	Principles of Inorganic Chemistry	B. R. Puri, L. R. Sharma, and K. C. Kalia	Milestone publications, 33 rd ed., 2015.
V	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma and S. P. Madhan	Vishal publications, 47 th ed., 2015

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Organic Chemistry	R.T. Morrison, R.N. Boyd, and S. K. Bhattacharjee	Pearson Education Ltd., 7 th ed., 2011.
2.	Organic Chemistry (Vol-I)	I. L. Finar	Pearson Education Asia, 6 th ed., 2012
3.	Inorganic Chemistry- Principles of structure and reactivity	J. E. Huheey, E. A. Keiter, R. L. Keiter and O.K. Medhi	Pearson education Ltd., 4 th ed., 2012
4.	Physical Chemistry	Peter Atkins, Julio De Paula	Oxford university press, 9 th ed., 2013
5.	Textbook of physical chemistry	Samuel Glasstone	Macmillan India publications, 1 st ed., 1971

E-Resources: (Web resources & E-books)

- <http://www.chemeddl.org/resources/pt/>
- <http://www.chemeddl.org/resources/biographies/>
- <http://www.chemeddl.org/resources/glossary/>
- <https://chemistry.com.pk/books/organic-chemistry-9e-john-mcmurry/>
- <https://chemistry.com.pk/books/organic-chemistry-9e-francis-carey/>
- <https://chemistry.com.pk/books/concise-inorganic-chemistry-jd-lee/>
- <https://chemistry.com.pk/books/shriver-atkins-inorganic-chemistry-5e/>
- <https://chemistry.com.pk/books/atkins-physical-chemistry-9e/>
- <http://www.archive.org/details/textbookofphysic00lincrich>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's Taxonomy level
CO 1	H	-	-	-	M	M	A
CO 2	M	L	M	L	M	M	A
CO 3	H	M	-	M	M	M	A
CO 4	H	L	-	-	M	M	A
CO 5	H	L	-	-	L	M	A

Content delivery Methods (Minimum Two) :

- Lecture method
- Power point presentation

- Flip class room
- Seminar
- Video
- Visual aids
- ICT-open source
- Problem solving

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Seminar / JAM	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Seminar / JAM	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10 X 1= 10 marks)
Section B	Either or Type - 5 Questions (5 X 4= 20 marks)
Section C	Either or Type - 5 Questions (5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Seminar / JAM (4)
R	30%	30%	Overall Structure:25% (1 Mark) Content :50% (2 Marks) Presentation : 25% (1 Mark)	Presentation : 50% (2 Marks) Content : 25% (1 Mark) Interaction/overall Effort :25% (1 Mark)
U	40 %	40 %		
A	30 %	30 %		

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory; P-Problems																		
	MCQ																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	a	b	a	b	a	b	a	b	a	b	a	b	a	b
I	✓	✓									T	T					T	T																
II			✓	✓								T	T					T	T															
III					✓	✓							T	T						T	T & P													
IV							✓	✓						T	T												T	T						
V									✓	✓							T	T										T	T & P					

Course Designed by	Mrs. V. Anitha	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B.Sc Chemistry
Semesters I and II

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core Practical I Semi-micro Qualitative Analysis	Course Code: 217CP1
Semesters: I and II	No. of Credits: 3
No. of hours : 90	P: R 78:12
CIA Max. Marks: 25	ESE Max. Marks:50

(P: Practical hours, R: Record and observation work)

Course Objectives:

- To impart sound theoretical knowledge in semi-micro qualitative analysis.
- To expose the students to laboratory hygiene and safety methods.
- To enhance the skill of handling chemicals, glass wares and apparatus used in semi-micro qualitative analysis.
- To apply the chemistry principles in the qualitative analysis.
- To familiarize with filtration, precipitation, decantation, heating, centrifugation and separation techniques.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Gain sound theoretical knowledge in semi-micro qualitative analysis.	U
CO2	Handle chemicals, glass wares & apparatus, apply semi-micro qualitative principles i.e. express the physical & chemical processes, use the heating, decantation & centrifugation processes, examine precipitation & filtration processes & assess the anions in mixture by analytical methods & analyze and distinguish the cations to the groups.	A
CO3	Implement laboratory hygiene and safety methods.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

I.	Reactions involving anions: Carbonate, sulphate, nitrate, fluoride, chloride, bromide, oxalate, phosphate and borate.
II.	Reactions involving cations: Lead, bismuth, copper, cadmium, iron, manganese, aluminium, cobalt, nickel, zinc, barium, calcium, strontium, ammonium and magnesium.
III.	Analysis of a mixture containing 2 cations and 2 anions of which one may be an interfering radical requiring elimination during the analysis.
IV.	Group experiments:
(i)	Demonstration of common ion effect using

- (a) CuCl_2 and NaCl
 (b) liq. NH_3 and NH_4Cl .
 (ii) Separation of immiscible liquids using a volatile organic solvent.

V. Demonstration

Identification of Chromate and iodide ion

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Vogel's Text Book of Practical Organic Chemistry	B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell	Pearson Edn., Ltd., 5 th ed., 2009.
2.	Basic Principles of Practical Chemistry	V. Venkateswaran, R. Veeraswamy, and A. R. Kulandaivelu,	S. Chand and Sons publications, 2 nd ed., 2016.
3.	Advanced Practical Chemistry	RaghupatiMukhopadhyay, and Pratul Chatterjee	Books and Allied publications, 3 rd ed., 2007

E-Resources: (Web resources & E-books)

<https://chemistry.com.pk/books/vogels-textbook-quantitative-chemical-analysis-5e/>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's Taxonomy level
CO 1	H	H	M	H	H	H	U
CO 2	H	H	M	H	H	H	A
CO 3	H	H	M	H	H	H	A

Content delivery Methods (Minimum Two) :

1. Demonstration
2. Lecture Method
3. Video Class
4. Virtual Laboratory
5. Problem Solving

Course Evaluation Methods:

Direct Methods	Indirect Methods
Lab Performance Record Model Examination	Course Exit Survey

Internal Assessment components:

Components	Lab Performance	Record	Model Examination	Attendance	Total
Marks	8	8	7	2	25

Question Paper Pattern

Section	Experiments	Weightage
A	Semi micro Analysis	90 % (45 Marks)
B	Viva Voce (Questions from CO1, CO2 and CO3)	10 % (05 Marks)

Evaluation will be made based on Weightage % given

Bloom's Category	Lab performance (8)	Record (8)	Model Examination
A	Punctuality : 25% (2 Marks) Safety and Hygiene : 25% (2 Marks) Experimental Skill : 25% (2 Marks) Observation Note : 25% (2 Marks)	Punctuality : 25% (2 Marks) Neatness : 25% (2 Marks) Calculations: 25% (2 Marks) Accuracy : 25% (2 Marks)	Marks converted to 7 marks

ESE Assessment components:

Semi micro analysis	: 45 marks
Viva	: 05 marks
Total	: 50 marks
Scheme for Semi micro analysis : 45 marks	
a. 4 Ions correct with correct procedure	: 45 Marks
b. 3 Ions correct with correct procedure	: 34 Marks
c. 2 Ions correct with correct procedure	: 23 Marks
d. 1 Ions correct with correct procedure	: 12 Marks
e. Spotting of an Ion	: 5 Marks
f. Precipitating at the correct group	: 5 Marks
g. Correct detection of cations without eliminating the interfering Ion should be treated a spotting	: 5 Marks

Course Designed by	Mrs. M. Malarvizhi	
Course Reviewed by	Mrs. S. Umadevi	
Head of the Department:	Mrs. M. Malarvizhi	

B.Sc. Chemistry Semester III

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core III General Chemistry III	Course Code: 317C03
Semester: III	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T: Tutorial)

Course Objectives:

- To understand the chemistry of s- block, zero group elements and metallurgy.
- To learn various separation techniques.
- To explore the chemistry of alcohols, phenol, ethers and epoxides.
- To study the rate and rate constants of various reactions.
- To know the various concepts of photochemistry.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Compare , distinguish and organize various properties of elements and compounds of zero group, alkali and alkaline earth metals	A
CO2	Relate and account for different processes involved in metallurgy	A
CO3	Describe, discuss, apply and adopt different types of separation and purification techniques for experimental process	A
CO4	Apply standard methods to prepare alcohols, phenols, ethers and epoxides	A
CO5	Execute reactions involving the functional groups of alcohols, phenols, ethers and epoxides and predict their reaction products.	A
CO6	Comprehend , enumerate ,apply and interpret the basic laws and principles of kinetics, catalysis and photochemistry.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Chemistry of s-block & zero group elements and metallurgy (11 Hours)

s- block elements: general characteristics– chemical properties– comparative study of hydroxides, oxides and halides of alkali metals- comparative study of oxides, carbonates and sulphates of alkaline earth metals- diagonal relationship of Li & Mg, Be & Al.

Zero group elements- position in the periodic table- occurrence- isolation-uses- chemistry of Xe compounds- XeF₆& XeOF₄.

Metallurgy : Occurrence of metals – concentration of ores – Froth floatation- magnetic separation- calcinations- roasting- smelting- aluminothermic process- purification of metals: electrolysis, zone refining and van Arkel process.

Unit II: Purification Techniques (10Hours)

Experimental techniques: distillation, fractional distillation, distillation under reduced pressure- solvent extraction.

Chromatography: Definition- types- adsorption and partition chromatography- Principle, technique and applications of Thin layer chromatography, Column chromatography and Paper chromatography. Principle and applications of Gas chromatography, Ion- exchange chromatography and High performance liquid chromatography.

Unit III – Hydroxy Derivatives, Ethers and Epoxides (11 Hours)

Aliphatic alcohols: Preparation: hydroboration, oxidation, reduction of carbonyl compounds, epoxidation, and Grignard synthesis- Reactions with reference to C-OH bond cleavage and O-H bond cleavage, distinction between primary, secondary and tertiary alcohols .

Phenols: Nomenclature- Preparation: Industrial source, preparation from diazonium salts and sulphonic acids- Physical properties: hydrogen bonding- Chemical Properties: acidity, ether formation, ester formation, electrophilic aromatic substitution- nitration, sulphonation, halogenation, Friedel-Craft's reaction, nitrosation, coupling reactions, Kolbe's reaction and Riemer-Tiemen reaction- preparation and properties of catechol, resorcinol and phloroglucinol.

Ethers: Nomenclature and classification of ethers- Preparation: Dehydration of alcohols, Williamson's synthesis and alkoxymercuration- Reactions: cleavage by acids- Epoxide: Preparation and reactions of epoxides.

Unit IV: Chemical Kinetics and Catalysis (10 Hours)

Chemical Kinetics: Introduction- Rate equation, order and molecularity- expression for rate and half- life periods of first, second and zero order reactions- determination of order of reactions- effect of temperature on reaction rate: Arrhenius equation- simple collision theory – activated complex theory- Lindemann's theory of unimolecular reaction rate.

Catalysis: Introduction- general characteristics- acid base catalysis- enzyme catalysis: mechanism and kinetics of enzyme catalyzed reactions- Michaelis- Menton equation - significance of k_m .

Unit V: Photochemistry (10 Hours)

Introduction- Photochemical Vs Thermal reactions- laws of photo chemistry: Beer – Lambert's law, Grothus Draper law - Stark – Einstein's law of photochemical equivalence - Quantum yield: definition- experimental determination: primary and secondary processes- kinetics of thermal and photochemical reactions: $H_2 - Br_2$ reaction- Jablonski diagram- fluorescence-phosphorescence-photosensitization-chemiluminescence-thermoluminescence- bioluminescence- photo synthesis - definition with example.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I	Satya Prakash's Modern Inorganic Chemistry	R. D. Madan	S. Chand and Sons publications, 3 rd ed., 2014.
II	Instrumental approach to chemical analysis	A. K Srivastava and P.C. Jain	S. Chand and Sons publications, 4 th ed., 2013
II	Elements of Analytical	R. Gopalan,	S.Chand and Sons publications,

	Chemistry	P. S. Subramanian and K. Rengarajan	3 rd ed., 2016
III	Modern Organic Chemistry	M. K. Jain and S. C. Sharma	Vishal Publications, Co-4 th ed., 2016
III	Advanced Organic Chemistry	ArunBahl and B. S. Bahl	S. Chand and Sons publications, 3 rd ed., 2014.
IV & V	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma and S. P. Madhan	Vishal publications, 47 th ed., 2015

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Shriever& Atkins' Inorganic Chemistry	Peter Atkins, Tina Overton and Jonathon Rourke	Oxford university press, 4 th ed., 2012.
2.	Instrumental methods of chemical analysis	H. Kaur	PragathiPrakasan publications, 6th ed., 2006.
3.	Organic Chemistry	R.T. Morrison, R.N. Boyd, and S. K. Bhattacharjee	Pearson Education Ltd., 7 th ed., 2011.
4.	Textbook of physical chemistry	Samuel Glasstone	Macmillan India publications, 1 st ed., 1971

E-Resources: (Web resources & E-books)

- <http://chemistry.com.pk/books/analytical-chemistry-by-gary-d-christian/>
- <http://chemistry.com.pk/books/chromatographic-methods/>
- <https://chemistry.com.pk/books/organic-chemistry-9e-john-mcmurry/>
- <https://chemistry.com.pk/books/skoog-principles-of-instrumental-analysis/>
- <https://chemistry.com.pk/books/organic-chemistry-9e-francis-carey/>
- <https://chemistry.com.pk/books/concise-inorganic-chemistry-jd-lee/>
- <https://chemistry.com.pk/books/shriver-atkins-inorganic-chemistry-5e/>
- <https://chemistry.com.pk/books/atkins-physical-chemistry-9e/>
- <http://www.archive.org/details/textbookofphysic00lincrich>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's taxonomy
CO 1	H	-	-	-	M	M	A
CO 2	H	-	-	-	M	M	A
CO 3	H	M	-	M	M	M	A
CO 4	H	-	-	-	M	M	A
CO 5	H	-	-	-	M	M	A
CO 6	H	-	-	-	M	M	A

Content Delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Video Class
- Hands-on-training
- Demonstration
- Practical session

- Open source
- Peer teaching

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Internship	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Internship	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10 X 1= 10 marks)
Section B	Either or Type - 5 Questions (5 X 4= 20 marks)
Section C	Either or Type - 5 Questions (5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Internship (4)
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50% (2 Marks) Presentation :25% (1 Mark)	Report - 50% (2 Marks) Presentation - 25% (1 Mark) Viva- Voce - 25% (1 mark)
U	40%	40%		
A	30%	30%		

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10) MCQ										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory; P-Problems									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20					
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	
I	✓	✓									T	T					T	T							
II			✓	✓								T	T					T	T						
III					✓	✓							T	T					T	T					
IV							✓	✓						T	T						T	T & P			
V									✓	✓					T	T							T	T & P	

Course Designed	Mrs. M. Malarvizhi	
Course Reviewed	Mrs. S. Umadevi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – III

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part IV Non Major Elective : Chemistry in Everyday Life	Course Code: 317NCE
Semester: III	No. of Credits: 2
No. of hours : 30	C:T 26:4
CIA Max. Marks: 50	ESE Max. Marks: Nil

(C: Contact hours, T:Tutorial)

Course Objectives:

- To promote the core competency skills and augment citizenship values.
- To familiarize the students with few important chemical aspects of health care, beauty, medicine, housekeeping, industry, clinical health and biochemical analysis.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Review the chemistry of health care and beauty products.	A
CO2	Summarize the basics of classification of drugs and the chemical aspects of medicine.	A
CO3	Apply the knowledge of chemistry to understand the process of housekeeping products.	A
CO4	Specify and explain the chemistry of industrial process.	A
CO5	Relate the role of chemistry in Clinical Health and Biochemical Analysis.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Chemistry in Health Care and Beauty (5 Hours)

Health care: Vitamins and Proteins- Sources, Functions, Deficiency diseases.
Hazard alert and Precautions for safety: Asbestos, Silica, Lead paints, Cement, Welding fumes and gases.
Cosmetics: Face powder- Face cream- Lipstick- Mascara-Nail polish- Perfumes- Shampoo-Tooth paste-Ingredients and uses.

Unit II: Chemistry in Medicine (5 Hours)

Drug– definition of the following terms: drug, pharmacology, toxicology, chemotherapy, LD₅₀, ED₅₀ and therapeutic index- Analgesics, Anaesthetics, Antibiotics, Antacids, Hypnotics and Antidepressant drugs: definition, examples and uses.

Unit III: Chemistry in Housekeeping (5 Hours)

Soaps- Definition, Varieties of soap and their uses- Cleansing action of soap -Detergents, Deodorants, Acid Cleaners, Laundry aids, Alkaline cleaners, Metal Polishes, Solvent cleaners, Floor seal, Abrasive, Antiseptics, Disinfectants- Definition, Ingredients and examples.

Unit IV: Chemistry in Industry**(6 Hours)**

Role of Chemistry in photography-Photographic process-preparation of sensitive plates-exposure-developing-fixing-printing-toning-colour photography.

Food industry: Food adulterants and testing, Food colorants, Food preservatives and Food additives.

Agriculture: Fertilizer-Bio fertilizers- requisites manufacture and uses- micronutrients, macronutrients and mixed fertilizers- definition and examples-Pesticides and Insecticides-definition and examples- Ill effects of Pesticides and Insecticides in soil and plants.

Plastics-Definition, Types, Examples and Recycling of plastics.

Unit V: Chemistry in Clinical Health and Biochemical Analysis**(5 Hours)**

Diagnostic test for sugar, salt and cholesterol in serum and urine- detection of hallucinogens and poisons- Antitodes for poisons- Detection of anemia and diabetics-Transport of Oxygen and maintenance of pH of blood, Analysis of Rh factor, Blood pressure-Normal, High and Low and to control.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I and III	Text book of applied chemistry	Thangamma Jacob	Macmillan publications, Home science and allied science 1 st ed., 1987.
IV	Industrial chemistry	B.K. Sharma	Goel publications, 12 th ed., 2016
II and V	Organic pharmaceutical chemistry	H. Singh and V. K. Kaboor	Vallabh Prakashan publications, 1 st ed., 1983.
	A text of pharmaceutical chemistry	Jayashree ghosh	S. Chand and Sons publications, 3 rd ed., 2014.

E-Resources : (Web resources & E-books)

- <http://ncert.nic.in/ncerts/l/lech207.pdf>
- https://www.researchgate.net/publication/309637872_Chemistry_in_Our_Daily_Life_Preliminary_Information_International_Journal_of_Home_Science

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	M	-	L	L	M	-	A
CO 2	M	-	L	L	M	-	A
CO 3	M	-	L	L	M	-	A
CO 4	M	-	L	L	M	-	A
CO5	M	-	L	L	M	-	A

Content Delivery Methods (Minimum Two):

- Traditional Method
- PPT and Video
- Home Made Products - Preparation
- Report Making
- Seminar

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Activity (Assignment / Group Discussion / Modeling a Concept/ Seminar)	Course Exit Survey

Internal Assessment components:

Components	CIA I	CIA II	Activity (Assignment / Group Discussion / Modeling a Concept/ Seminar)	Total
Marks	20	20	10	50

Question Paper Pattern

Section A	Either or Type - 5 Questions (5 X 4=20)
Section B	Either or Type - 5 Questions (5 X 6=30)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (50)	CIA II (50)	Activity (Assignment / Group Discussion / Modeling a Concept/ Seminar) (10)
R	30%	30%	Overall Structure: 25% (2.5 Marks) Content : 50% (5 Marks) Presentation :25% (2.5 Marks)
U	40%	40%	
A	30%	30%	

Course Designed by	Mrs. J. Bhuvanewari	
Course Reviewed by	Mrs. S. Umadevi	
Head of the Department	Mrs. M. Malarvizhi	

B.Sc. Chemistry Semester III

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part IV Skill Enhancement Course I Applications of Computer in Chemistry	Course Code: 317CS1
Semester: III	No. of Credits: 3
No. of hours : 45	C:T:P 24:6:15
CIA Max. Marks: 75	ESE Max. Marks: -

(C: Contact hours, T: Tutorial, P: Practical)

Course Objectives:

- To promote the core competency skills and augment citizenship values.
- To enable students to communicate chemical structures and perform data analysis.
- To familiarize with working of Chemdraw and Origin software.
- To know the fundamental concepts of cheminformatics.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Emerge as skilled one in chemdraw and origin software.	A
CO2	Apply chemdraw to draw accurate chemical structures scheme, reactions and its mechanisms	A
CO3	Exploit origin to draw simple and advanced 2D and 3D plot charts, the absorption, emission and IR spectrum using Origin from the given data.	A
CO4	Gain basic knowledge in cheminformatics	R

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Chemdraw

(10 Hours)

Introduction- salient features in Chemdraw- Main tools- optional tools- Significance of Chemdraw- Chemdraw Shortcuts- Drawing Chemical Structures and pasting them in the text- Working with Structures - drawing schemes - Chemdraw analysis - Advantages.

Unit II: Origin

(11 Hours)

Origin – Introduction – significance – toolbars– Workbook and Worksheet Operations - Multi-sheet Workbooks – file types (opj and ascii) - Importing Data from different sources - Basic Data Manipulation - Creating and Customizing Graphs - Publishing Graphs (export) - Basic Data Analysis - Creating and Customizing Multilayer Graphs - graph types - origin in chemistry - Working with Excel and Origin.

Unit III: Cheminformatics

(3 Hours)

Introduction to cheminformatics, History and Evolution of cheminformatics - Uses of cheminformatics.

Practicals**(15 Hours)**

1. Draw the structure of molecule using Chemdraw.
2. Draw the structure of macromolecule using Chemdraw.
3. Sketch the distillation process using Chemdraw template.
4. Sketch the titration process using Chemdraw template.
5. Sketch the given scheme using Chemdraw.
6. Draw the given organic reaction mechanism.
7. Draw and analyze the given structure by $^1\text{H-NMR}$ spectra.
8. Bring out analytical data of the given structure using Origin
9. Create of line graph and symbol graph using Origin.
10. Create line and symbol graph using Origin.
11. Create bar graph and pie chart using Origin.
12. Create stacked bar and column graph using Origin.
13. Create grouped columns – indexed graph using Origin.
14. Create 3D bar graph using Origin.
15. Import the given ascii data to draw the absorption, emission and IR spectrum using Origin.
16. Import the given multiple ascii data to draw the absorption, emission and IR spectra using Origin.
17. Export the graph to pdf format using Origin.
18. Compare the excel bar diagram with origin bar diagram using Origin.

E-Resources: (Web resources & E-books)

- Database usage in Chemdraw and ChemOffice, Cambridge Soft (2010).
- https://library.columbia.edu/content/dam/libraryweb/locations/dsc/Software%20Subpages/ChemDraw_17_manual.pdf
- http://www.cambridgesoft.com/support/DesktopSupport/Documentation/Manuals/files/chemdraw_9_english.pdf
- <https://www.youtube.com/watch?v=olqgwovffU>
- <https://www.youtube.com/watch?v=-sjhlpQID6Q>
- <https://www.youtube.com/watch?v=Kt4UzYVFf6E>
- https://www.originlab.com/pdfs/Origin2017_Documentation/English/Origin_Tutorial_2_017_E.pdf
- Database usage in Origin (Microcal Software, Inc., One Roundhouse Plaza, Northhampton, MA -01060).
- <https://www.internetchemistry.com/chemistry/cheminformatics.htm>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's Taxonomy level
CO 1	H	H	L	-	M	M	A
CO 2	H	H	L	-	M	M	A
CO 3	H	H	L	-	M	M	A
CO 4	L	-	-	-	-	-	R

Content Delivery Methods (Minimum Two) :

- Lecture method
- Power point presentation
- Seminar
- Practical session
- Computational thinking
- ICT-open source
- Peer teaching
- Scientific thinking

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Lab performance Record	Course Exit Survey

Internal Assessment components:

Components	CIA I (Theory)	CIA II (Practical)	Lab performance	Record	Total
Marks	30	30	07	08	75

Question Paper Pattern

Theory	Section A	Either Or type - 5 Questions (5 X 4= 20)
	Section B	Either Or type - 5 Questions (5 X 8= 40)
Practical	Three out of five (3 X 20= 60)	

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (60)	CIA II (60)	Lab performance (7)	Record (8)
R	20 %	-	Punctuality : 43% (3 Marks)	Punctuality : 25% (2 Marks)
U	40 %	40 %	Experimental Skill: 28.5% (2 Marks)	Neatness : 25% (2 Marks)
A	40 %	60 %	Observation Note : 28.5% (2 Marks)	Calculations: 25% (2 Marks) Accuracy : 25% (2 Marks)

Course Designed by	Mrs. V. Anitha	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – IV

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core IV General Chemistry IV	Course Code: 417C04
Semester: IV	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To acquire knowledge in basic concepts of solid state chemistry.
- To understand basic concept of liquid state and liquid crystals.
- To appreciate the principles and significance of solutions and colligative properties.
- To learn and understand the chemistry of nitro and amine compounds.
- To understand the basic chemistry of heterocyclic compounds and natural products

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Relate the principle, physical attributes of the liquid state and the solid state	A
CO2	Generalise Liquid State and Liquid Crystals .	A
CO3	Predict solutions in non-electrolytes, colligative properties and their uses in determining the characteristic of solutions.	A
CO4	Review the chemistry of nitrogen containing compounds like nitrobenzene, amines, amides and azo compounds	A
CO5	Apply and predict the reactivity of heterocyclic compounds	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I –Solid State	(11 Hours)
Introduction- classification- properties- symmetry in crystals- basic crystal system- space lattice and unit cell- Bravais lattices- Miller indices- types of crystals- cubic and hexagonal packing- radius ratio rule- tetrahedral and octahedral voids- X-ray diffraction: Bragg's equation, rotating crystals and powder method- Structure of ionic solids: NaCl, KCl and ZnS (unit cell diagrams)- crystal defects.	
Unit II- Liquid State and Liquid Crystals	(8 Hours)
Liquid state- density- diffusion- viscosity: effect of temperature and pressure- evaporation- surface tension: effect of temperature- Parachor: definition and its applications - Liquid crystals: introduction, characteristics and classification.	

Unit III: Solutions in non-electrolytes and Colligative Properties (11Hours)

Solutions in non-electrolytes: Introduction-solutions of liquid in liquid- Raoult's law: vapour pressure of ideal solution- activity of a component in ideal solution- chemical potential of ideal and non-ideal solution- Gibb's- Duhem – Margules equations- types of non ideal solutions- introduction and azeotropic mixture formation in detail- partially miscible liquid system: phenol- water- solutions of gases in liquids- Henry's law, its relationship with Raoult's law.

Colligative properties: Introduction- vapour pressure lowering, elevation of boiling point, depression of freezing point and osmotic pressure: definition and derivation only- vant't Hoff factor and its application to determine degree of dissociation and degree of association- Nernst Distribution law and its applications.

Unit IV- Nitrogen Containing Compounds (11 Hours)

Nitro compounds: Introduction- test for nitro groups- Nitrobenzene: preparation- properties: reduction, electrophilic and nucleophilic substitution- uses.

Amines: separation of a mixture of primary, secondary and tertiary amines- preparation, properties and uses of ethylamine, dimethylamine and aniline- relative basic character of aliphatic and aromatic amines- Preparation and properties of benzene diazonium chloride, alkyl azides, acetamide and benzamide.

Unit V – Heterocyclic compounds and Active methylene groups (11 Hours)

Heterocyclic Compounds: Introduction- nomenclature- preparation and properties of furan, pyrrole and thiophene- preparation, properties, structural elucidation and basicity of pyridine - comparison of basicity of pyridine and pyrrole- condensed ring system: preparation and properties of indole, quinoline and isoquinoline.

Active methylene groups: Ethylacetoacetate- preparation, properties, tautomerism and synthetic uses (synthesis of butanoic acid, Pentanone, Succinic acid and 4-methyl uracil) - diethylmalonate: preparation, properties and synthetic uses (synthesis of 2-methyl butanoic acid, adipic acid, barbuturic acid and ethylmethyl ketone).

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I and II	Principles of Inorganic Chemistry	B. R. Puri, L. R. Sharma, and K. C. Kalia	Milestone publications, 33 rd ed., 2015.
I and II	Satya Prakash's Modern Inorganic Chemistry	R. D. Madan	S. Chand and Sons publications, 3 rd ed., 2014.
III	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma and S. P. Madhan	Vishal publications, 47 th ed., 2015.
IV and V	Modern Organic Chemistry	M. K. Jain and S. C. Sharma	Vishal Publications, 4 th ed., 2016.
IV and V	Advanced Organic Chemistry	Arun Bahl and B. S. Bahl	S. Chand and Sons publications, 3 rd ed., 2014.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Inorganic Chemistry- Principles of structure and reactivity	J. E. Huheey, E. A. Keiter, R. L. Keiter and O.K. Medhi	Pearson education Ltd., 4 th ed., 2012
2.	Shriver& Atkins' Inorganic Chemistry	Peter Atkins, Tina Overton and Jonathon Rourke	Oxford university press, 4 th ed., 2012
3.	Atkins' Physical Chemistry Peter Atkins	Julio De Paula	Oxford university press, 9 th ed., 2013.
4.	Organic Chemistry	R.T. Morrison, R.N. Boyd, S. K. Bhattacharjee	Pearson Education Ltd., 7 th ed., 2011
5.	Organic Chemistry (Vol- I)	I. L. Finar	Pearson Education Asia, 6 th ed., 2012

E-Resources: (Web resources & E-books)

- <http://www.chemeddl.org/resources/ptl/>
- <http://www.chemeddl.org/resources/biographies/>
- <http://www.chemeddl.org/resources/glossary/>
- <https://chemistry.com.pk/books/organic-chemistry-9e-john-mcmurry/>
- <https://chemistry.com.pk/books/organic-chemistry-9e-francis-carey/>
- <https://chemistry.com.pk/books/concise-inorganic-chemistry-jd-lee/>
- <https://chemistry.com.pk/books/shriver-atkins-inorganic-chemistry-5e/>
- <https://chemistry.com.pk/books/atkins-physical-chemistry-9e/>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's Taxonomy level
CO 1	H	-	-	L	L	M	A
CO 2	H	-	-	L	-	M	A
CO 3	H	-	-	M	L	M	A
CO 4	H	-	-	L	L	M	A
CO5	H	-	-	L	L	M	A

Content Delivery Methods (Minimum Two) :

- Lecture method
- Power point presentation
- Flip class room
- Models
- Video
- Open source

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Online Group Discussion / Modeling a Concept	Course Exit Survey

Internal Assessment components:

Components	CIA	Online	Group Discussion / Modeling a Concept	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I	CIA II	Group Discussion / Modeling a Concept	Online
R	30%	30%	Presentation: 50% (2 Marks) Content : 25% (1 Mark) Interaction/overall Effort :25% (1 Mark)	R - 30%
U	40%	40%		U - 40%
A	30%	30%		A - 30%

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10) MCQ										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20					
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	
I	✓	✓									T	T					T	T							
II			✓	✓								T	T					T	T						
III					✓	✓							T	T					T	T					
IV							✓	✓						T	T						T	T			
V									✓	✓					T	T							T	T	

Course Designed by	Mrs. R. Chitradevi	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – III and IV

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core Practical II Volumetric and Organic Analysis	Course Code: 417CP2
Semester: III and IV	No. of Credits: 4
No. of hours : 90	P:R 78: 12
CIA Max. Marks: 40	ESE Max. Marks:60

(P: Practical, R: Record and Observation)

Course Objectives:

- To impart sound theoretical knowledge in volumetric and organic analysis.
- To expose the students to laboratory hygiene and safety methods.
- To enhance the skill of handling chemicals, glass wares and apparatus used in volumetric and organic analysis.
- To acquire skills of doing quantitative estimations by titrimetry.
- To provide basic knowledge and skills for simple reactions in organic chemistry.
- To determine the functional group of an unknown organic compound.
- To understand the purpose of a synthetic derivative.
- To enable the students to estimate the organic compounds.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Gain sound theoretical knowledge in volumetric and organic analysis and implement laboratory hygiene and safety methods.	U
CO2	Perform accurate quantitative measurements, calculations and draw accurate conclusions and predict the outcome of qualitative organic reactions and prepare suitable derivatives.	A
CO3	Distinguish between qualitative and quantitative chemical analysis	A

R-Remembrance U –Understanding A-Apply

Syllabus:

<p>I. Volumetric analysis</p> <p>A. Acidimetry and alkalimetry</p> <ol style="list-style-type: none"> 1. Estimation of oxalic acid 2. Estimation of sodium carbonate 3. Estimation of hydrochloric acid <p>B. Permanganometry</p> <ol style="list-style-type: none"> 1. Estimation of oxalic acid 2. Estimation of ferrous iron in ferrous sulphate 3. Estimation of Mohr's salt <p>C. (i) Iodometry</p> <ol style="list-style-type: none"> 1. Estimation of potassium dichromate 2. Estimation of copper <p>(ii) Iodimetry</p>
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Estimation of arsenious oxide (demo)

D. Dichrometry (demo)

1. Estimation of ferrous ion using external indicator
2. Estimation of ferric ion by reduction method

E. Group experiments

1. Determination of sodium hydroxide and sodium carbonate in a mixture
2. Estimation of calcium (direct method)
3. Determination of percentage of MnO₂ in pyrolusite
4. Estimation of chloride

II. A. Analysis of organic compounds

Systematic analysis of organic compounds:- preliminary tests, detection of elements, nature of functional groups, confirmatory tests and preparation of derivatives of acids, phenols, amides, amines (primary), anilides, carbohydrates, aldehydes, ketones, thiourea, nitro compounds and esters- **Micro scale level except for heating experiments.**

B. Estimation of organic compounds (Class work)

1. Estimation of Vitamin C.
2. Estimation of Glycine by formal titration.
3. Determination of Acid value of fats
4. Estimation of Ca in milk.
5. Determination of acetic acid in commercial vinegar.
6. Determination of alkali content of antacid tablets

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
1.	Basic Principles of Practical Chemistry	V. Venkateswaran, R. Veeraswamy, and A. R. Kulandaivelu	S. Chand and Sons publications, 2016.
2.	Advanced Practical Chemistry	Raghupati Mukhopadhyay, and Pratul Chatterjee	Books and Allied publications, 3 rd ed., 2007.
3.	Vogel's Text Book of Practical Organic Chemistry	B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell	Pearson Edn., Ltd., 5 th ed., 2009.

E-Resources : (Web resources & E-books)

- <http://vlab.amrita.edu/>
- <http://vlab.amrita.edu/?sub=2&brch=193&sim=352&cnt=1>
- <http://vlab.amrita.edu/?sub=2&brch=191>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	H	-	M	M	M	M	U
CO 2	H	-	M	M	M	M	A
CO 3	H	-	M	M	M	M	A

Course delivery Methods (Minimum Two) :

- Lecture Method
- Demonstration Class

- Virtual Laboratory
- Problem Solving

Course Evaluation Methods:

Direct Methods	Indirect Methods
Lab Performance Record Model Practical Examination	Course Exit Survey

Internal Assessment components:

Components	Lab Performance	Record	Model Practical Examination	Attendance	Total
Marks	12	16	10	02	40

Question Paper Pattern

Section	Experiments	Weightage
A	Volumetric Analysis	40 % (24 Marks)
B	Organic Analysis	50 % (30 Marks)
C	Viva Voce (Questions from CO1, CO2 and CO3)	10 % (06 Marks)

Evaluation will be made based on Weightage % given

Bloom's Category	Lab performance (12)	Record (16)	Model Examination
A	Punctuality : 25% (3 Marks) Safety and Hygiene : 25% (3 Marks) Experimental Skill : 25% (3 Marks) Observation Note : 25% (3 Marks)	Punctuality : 25% (4 Marks) Neatness : 25% (4 Marks) Calculations: 25% (4 Marks) Accuracy : 25% (4 Marks)	Model Examination Marks converted to 10 marks

ESE Assessment components:

Volumetric analysis	: 24 Marks
Organic Analysis	: 30Marks
Viva voce	: 6 Marks
Volumetric analysis : 24 Marks	
Volumetric Error upto 2%	24 Marks
Error upto 2-3%	20 Marks
Error upto 3-4%	15 Marks
Above 5%	10 Marks
Organic Analysis: 30Marks	
Element Present/ absent correctly reported	3 x 2 - 6 Marks
Aliphatic/ Aromatic	2 x 1 - 2 Marks
Saturated/ unsaturated	3 x 1 - 3 Marks
Preliminary test	10 Marks
Functional group	4 Marks
One solid derivative	5 Marks

Course Designed by	Mrs. S. Umadevi	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

**B. Sc Chemistry
Semester –IV**

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part IV Skill Enhancement Course II Chemistry for Exploration I	Course Code: 417CS2
Semester: IV	No. of Credits: 3
No. of hours : 45	P:I:T 24:15:6
CIA Max. Marks: 75	ESE Max. Marks: -

(P:Practical , I:Internship, T: Tutorial)

Course Objectives:

- To upgrade the technical skills and knowledge in the preparation of household products.
- To develop entrepreneurship skills
- To carry out general chemical work in academic laboratories.
- To obtain skill in handling burner, Kipp's apparatus and adopting separating techniques
- To separate and purify mixture of chemicals using different methods.
- Enhance knowledge and skill in the particular area of internship
- Assist development of employer-valued skills such as teamwork, communications and attention to detail.
- Assume responsibility for varied duties and job function

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Design and develop a small business marketing plan using household products.	A
CO2	Utilize the appropriate laboratory equipment and instrumentation.	A
CO3	Assess real-world experience through off-campus, laboratory-based work in a chemistry related field.	A
CO4	Generate scientific communication skills by writing a technical report and delivering an oral.	A

Syllabus:

a) Industrial Visit (2 No.) Report Making on the visit	- 12 hours
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b) Preparation of following house hold products**(Formulation and procedures)****- 14 lab hours**

Soap	Talcum powder	Bed bug repellent	Cake
Detergent	Shampoo	Mosquito repellent	Bread
Laundry blue	Perfumes	Cockroach repellent	Biscuits
Bleaching powder	Tooth powder	Chalk	Homemade chocolates
Phenoyl	Tooth paste	Candle	Ink
Incandescent sticks	Kumkum	Laundry starch	Cutflower Preservative

c) Basic experiments in Chemistry**- 13Hours**

TITLE	Time in hours
Experiment :1 Servicing bunsen burners	1
Experiment :2 To bore a hole in a cork	1
Experiment :3 Preparation of H ₂ S gas using Kipp's apparatus	1
Experiment :4 Calibration of volumetric apparatus	2
Experiment :5 Preparation of laboratory reagents	1
Experiment :6 Column chromatography-Separation of methylene blue and malachite green	1
Experiment :7 Paper chromatography- Separation of metal ions of group I	1
Experiment :8 TLC – Separation of different types of inks and aminoacids	1
Experiment :9 Distillation and sublimation	2
Experiment :10 Solvent purification-Ethanol and acetone	2

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
a, b and c	Text book of applied chemistry	Thangamma Jacob	Macmillan publications, Home science and allied science 1 st ed., 1987.
a, b and c	Industrial chemistry	B.K. Sharma	Goel publications, 12 th ed., 2016.

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/103108100/40>
- <https://nptel.ac.in/courses/103103034/21>
- <https://nptel.ac.in/courses/103105110/38>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's Taxonomy level
CO 1	H	H	M	H	H	H	A
CO 2	H	H	M	H	H	H	A
CO 3	H	H	M	H	H	H	A
CO 4	H	H	H	H	H	H	A

Content Delivery Methods (Minimum Two):

- Video
- Hands-on-training
- Demonstration
- Practical session
- Industrial visit.
- Experiential learning
- Problem solving

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Industrial visit Record	Course Exit Survey

Internal Assessment components:

Components	I CIA (Practical)	II CIA (Practical)	Industrial visit	Record	Total
Marks	30	30	10	5	75

Question Paper Pattern - Practical

Section A	Preparation of house-hold products (2 × 15 = 30 Marks)
Section B	Experiment (2 × 15 = 30 Marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	I CIA (Practical)	II CIA (Practical)	Industrial visit (10)	Record (5)
A	Practical - 20 marks (Converted from 60 marks of I CIA) Lab Performance- 10 Punctuality : 20% (2 Marks) Safety and Hygiene : 20% (2 Marks) Experimental Skill : 60% (6 Marks) Total: 30 marks	Practical - 20 (Converted from 60 marks of II CIA) Lab Performance- 10 Punctuality : 20% (2 Marks) Safety and Hygiene : 20% (2 Marks) Experimental Skill : 60% (6 Marks) Total: 30 marks	Report - 5 Overall Structure: 20% (1 Mark) Content : 60% (3 Marks) Presentation : 20% (1 Mark) Total: 10 marks	Punctuality and Neatness: 60% (3 Marks) Calculations and Accuracy: 40% (2 Marks)

Course Designed by	Mrs. R. Chitradevi	
Course Reviewed by	Mrs. S. Umadevi	
Head of the Department	Mrs.M.Malarvizhi	

B.Sc. Chemistry
Semester IV

(For the students admitted from the academic year 2017 – 2018 onwards)

Advanced Learner's Course I: Food Science	Course Code: 417ALC
Semester: IV	No. of Credits: 4*
No. of hours : -	C:T -
CIA Max. Marks: -	ESE Max. Marks:100

(C: Contact hours, T: Tutorial)

Course Objectives:

- To familiarize the students with the topics like nutrients, additives and quality of the food and also the methods to preserve food.
- To recognize the chemistry underlying the properties and reactions of various food components.
- To comprehend the principles involving food preservation.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the food groups & major nutrients and constituents of food	U
CO2	Acquire fundamental information about food additives.	U
CO3	Discuss the food adulterants and standards the theory of food adulteration and food safety & standards	U
CO4	Enumerate the principles involved in food preservation and the importance of food preservation and processing.	A
CO5	Make use of testing food quality and explicit its importance	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Constituents of Food

Introduction to food science- Food groups and their major nutrients- Constituents of food carbohydrates, proteins, fats and oils, emulsifiers, enzymes, pigments and colors, flavors, vitamins and minerals, natural toxicants and water(elementary treatment only)

Unit II: Food Additives

Food additives- definition- need, classification- Antioxidants, chelating agents, coloring agents, curing agents, humectants, anticaking agents- Preservatives: definition, action of sodium chloride, sorbic acid and acetic acid as preservative.

Unit III: Adulteration

Adulteration- definition, types- intentional and incidental, metallic and other contaminations- Simple test to detect food adulterants- Food safety and standards- national (BIS) and international standards(CODEX)- FSSAI.

Unit IV: Food Preservation and Processing

Food spoilage- Causes, Types- Food preservation- Preservation and processing by heating- sterilization, pasteurization and blanching Preservation and processing by low

temperature- slow freezing, quick freezing and dehydro freezing.

Unit V: Food Quality

Reason for testing food quality- Sensory evaluation- appearance, colour, flavour (odour, taste and mouth feel) - types of tests- difference test (paired comparison test, triangle test)- Rating test- single sample and two sample difference test- objective evaluation: advantages and disadvantages- physico- chemical test methods of objective evaluation.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I to V	Food science	B. Sri Lakshmi	New age international (P) Ltd publications, 6 th ed., 2015
III-V	Food science	N. N. Potter, and J. H. Hotchkiss	CBS publications, 5 th ed., 2007.
I to V	Food Chemistry	H. K. Chopra, and P. S. Panesar	Narosa Publishing house, 1 st ed., 2013

E-Resources: (Web resources & E-books)

- <http://www.fao.org/docrep/w0073e/w0073e04.htm>
- <https://nptel.ac.in/courses/103107088/module4/lecture1/lecture1.pdf>
- <http://bis.gov.in/>
- <https://www.fssai.gov.in>
- <https://nptel.ac.in/courses/103103029/pdf/mod6.pdf>
- <https://nptel.ac.in/courses/103107088/17>

Blue Print for End Semester Examination

Bloom's Category	Section	Marks	Description	Total Marks
R	2 Questions	5 x 20 = 100	Questions covering all Units (Open choice 5 out of 8)	100
U	3 Questions			
A	3 Questions			

Question Paper Pattern (100 Marks) -Theory Paper for Advanced Learner's Course

Unit	Section A (5 x 20 = 100)							
	Open Choice							
	1	2	3	4	5	6	7	8
I	✓							
II		✓	✓					
III				✓				
IV					✓	✓		
V							✓	✓

Course Designed by	Mrs. V. Anitha	
Course Reviewed by	Mrs. R. Chitradevi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – V

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core V Organic Chemistry I	Course Code: 517C05
Semester: V	No. of Credits: 4
No. of hours : 75	C:T 65:10
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T:Tutorial)

Course Objectives:

- To differentiate chiral and achiral molecules and recognize stereoisomers including enantiomers, diastereomers, racemic mixture and meso compounds.
- To justify a reasonable mechanism for given organic reaction and recognize the importance of reaction intermediates.
- To explain Fisher, Sawhorse and Newmann projection formulas and perform energy calculations to explain ring strain.
- To acquire knowledge on various methods of preparation and properties of aldehydes and ketones.
- To discuss the nomenclature, preparation, properties and uses of carbonyl compounds and their derivatives.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Interpret the fundamental aspects of stereochemistry, optical activity in organic compounds, racemisation, resolution and geometrical isomerism	A
CO2	Predict a logical and detailed mechanisms for rearrangement reactions	A
CO3	Draw Fisher, Sawhorse and Newmann projection formulas, perform energy calculations, illustrate the preparation and properties of cyclo paraffins	A
CO4	Analyse the preparation, properties of carbonyl compounds and execute organic conversions.	A
CO5	Investigate the chemistry of carboxylic acids and their derivatives.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Stereoisomerism

(16 Hours)

Types of isomerism- stereoisomers- optical isomerism, optical activity, optical and specific rotations, conditions for optical activity, asymmetric center, chirality, achiral molecules, meaning of (+) and (-) and D and L notations, elements of symmetry, racemization, methods of racemization (substitution and tautomerism), methods of resolution: mechanical, seeding, biochemical and conversion to diastereomers- asymmetric synthesis: partial and absolute synthesis, Walden inversion-- notation of optical isomers - Cahn-Ingold-Prelog rules, R and S

notations for optical isomers with one and two asymmetric carbon atoms, erythro and threo representations- Optical activity in Lactic acid and Tartaric acid and in compounds not containing asymmetric carbon atoms namely biphenyls, allenes and spiranes.

Geometrical isomerism: Cis-trans, syn-anti and E-Z notations, methods of distinguishing geometrical isomers using melting point, dipole moment, dehydration, cyclisation and heat of hydrogenation.

Unit II: Molecular Rearrangements (14 Hours)

Classification as anionotropic, cationotropic, free radical, inter and intramolecular-rearrangement - Pinacol-pinacolone rearrangement : mechanism, evidence for carbonium ion intermediate formation-migratory aptitude - Beckmann, Hoffmann, Curtius and Benzilic acid rearrangements- Claisen rearrangement : sigmatropic-evidence for intramolecular nature and allylic carbon attachment- Wagner meerwin, and Fries rearrangement.

Unit III: Cycloalkanes and Conformational Analysis (10 Hours)

Cycloparaffins- Preparation using Wurtz reaction, Dieckmann's ring closure and reduction of aromatic hydrocarbons- Reactions: substitution and ring-opening reactions
Conformational Analysis- Baeyer's strain theory- Fisher, Sawhorse and Newmann representation of ethane, butane, cyclobutane and cyclohexane.

Unit IV: Aldehyde and Ketones (12 Hours)

Structure and reactivity of carbonyl groups- preparation and uses of formaldehyde, benzaldehyde, acetone and acetophenone- relative reactivities of aldehydes and ketones in nucleophilic additions - nucleophilic addition reactions with grignard reagent and water - condensation reactions: aldol (with mechanism), perkin, benzoin, knoevenagel, cannizzaro (with mechanism) and claisen- reduction reactions with sodium boro hydride, wolf- kishner reduction, clemmenson and MPV reduction (mechanism not necessary)- oxidation reaction with fehling, tollen's reagents and haloform reaction- polymerization reactions-comparitive study of acetaldehyde and benzldehyde ,acetaldehyde and acetone.

Unit V: Carboxylic Acids (13 Hours)

Nomenclature and classification of aliphatic and aromatic carboxylic acids- General methods of preparation- Acidity (effect of substituents on acidity) and salt formation- Reactions: Mechanism of reduction, substitution in alkyl and aryl group- Preparation and properties of dicarboxylic acids: oxalic, malonic, Succinic, glutaric, adipic and Phthalic acids- Preparation and properties of unsaturated carboxylic acids: acrylic, crotonic and Cinnamic acids- Reactions: Action of heat on hydroxy and amino acids, and saturated dicarboxylic acids, stereospecific addition to maleic and fumaric acids- Preparation and reactions of acid chlorides, acid anhydrides, amides and esters: acid and alkaline hydrolysis of esters, trans-esterification.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Advanced Organic Chemistry	Arun Bahl and B. S. Bahl	S. Chand and Sons publications, 3 rd ed., 2014.
	Modern Organic Chemistry	M. K. Jain and S. C .Sharma	Vishal Publications, 4 th ed., 2016.
	Text book of Organic Chemistry	Raj K Bansal	New Age International Publications, 6 th ed., 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Organic Chemistry	K. S. Tewari, and N. K. Vishnoi	Vikas publications, 3 rd ed., 2015.
2.	Mechanism of organic reactions	K. S. Mukherjee	Books and Allied publications, 1 st 2015.

E-Resources : (Web resources & E-books)

- <http://www.freebookcentre.net/>
- <http://www.chemeddl.org/resources/stereochem/priorities1.htm>
- <https://www.scribd.com/doc/97295442/Molecular-Rearrangements>
- <https://ether.chem.iitb.ac.in/~kpk/ra.pdf>
- <https://nptel.ac.in/courses/104101005/downloads/LectureNotes/chapter%2011.pdf>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	H	L	L	L	H	L	A
CO 2	H	L	L	L	H	L	A
CO 3	H	L	L	L	H	M	A
CO 4	H	L	L	L	H	L	A
CO 5	H	L	L	L	H	L	A

Content Delivery Methods (Minimum Two) :

- Lecture method
- Power point presentation
- Flip class
- Seminar
- Visual aids
- Charts and posters
- Demonstration
- Open source
- Problem solving
- Peer teaching

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Quiz	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Quiz	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4 = 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9 = 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Quiz (4)
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50% (2 Marks) Presentation :25% (1 Mark)	R - 30%
U	40%	40%		U - 40%
A	30%	30%		A - 30%

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory					
	MCQ																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
I	✓	✓									T	T									
II			✓	✓								T	T					T	T		
III					✓	✓							T	T				T	T		
IV							✓	✓						T	T				T	T	
V									✓	✓					T	T				T	T

Course Designed by	Mrs. S. Umadevi
Course Reviewed by	Mrs. M. Malarvizhi
Head of the Department	Mrs. M. Malarvizhi

B. Sc Chemistry Semester – V

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core VI Inorganic Chemistry I	Course Code: 517C06
Semester: V	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T: Tutorial)

Course Objectives:

- To know the nature of compounds formed by p- block elements.
- To learn the principles of gravimetric analysis
- To understand the nuclear forces that operate in atoms.
- To appreciate the importance of nuclear reactions in the modern world

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Pertain the preparation, properties, structures and uses of some important compounds of p- block elements	A
CO2	Make use of the principles involved in Gravimetric analysis and apply the ethics in the process of precipitation	A
CO3	Employ the principles of radioactivity and nuclear chemistry in various fields	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: p- Block Elements I

(11 Hours)

p- block elements: General characteristics- diagonal relationship between Boron and Silicon- compounds of boron: preparation, properties, structures and uses of boric acid and diborane- compounds of silicon: classification and structure of silicates- structures and uses of zeolite, feldspar, ultramarine- preparation, properties, structures and uses of silicones- carbon: preparation, properties and uses of phosgene - allotropic forms of carbon- compounds of nitrogen and phosphorous- $\text{NH}_2.\text{NH}_2$, hydrazoic acid, PH_3 and POCl_3 .

Unit II: p- Block Elements II

(11 hours)

Oxygen: preparations, properties, structure and uses of ozone, hydrogen peroxide- Sulphur: allotropic forms- compounds of sulphur: preparation, properties, structure and uses of sulphur dioxide, sulphuric acid and oleum.

Halogens - General characteristics- anomalous behavior of Fluorine- preparation, properties and uses of sodium hypochlorite and perchloric acid- Interhalogen compounds: Introduction- general properties and uses- pseudohalides- comparative study of pseudohalides.

Unit III: Gravimetric Analysis**(10 Hours)**

Gravimetric analysis: Introduction- Methods of obtaining the precipitate- conditions for precipitation and desirable properties of precipitates- choice of precipitants- types of precipitants- Specific and selective precipitants, masking and demasking agents.

Solubility product and Precipitation: factors affecting the solubility of precipitates- Theories of precipitation- Co-precipitation- Post-precipitation- General rules of precipitation- procedure to minimize occlusion and Surface adsorption- Effect of Digestion- precipitation from homogeneous medium- Cation release Method- types of wash solutions- drying of precipitate.

Unit IV: Radio Activity**(10 Hours)**

Introduction- types, properties and uses of radioactive rays- natural and artificial radioactivity- detection and measurement of radioactivity: Wilson's cloud chamber and Geiger-Muller counter method- radioactive disintegration: α , β and γ emission- laws of radioactive disintegration- half- life period- average life period- law of successive disintegration- group displacement law- radioactive series.

Unit V: Nuclear Chemistry**(10 Hours)**

Definition and examples of isotopes, isobars and isotones- isotopes of hydrogen- detection of isotopes: Aston's mass spectrograph and Dempster's mass spectrograph- separation of isotopes: gaseous diffusion method and electromagnetic method- N/P ratio- Mass defect- magic number- nuclear binding energy- packing fraction- uses of isotopes in the study of agriculture, medicine, radio carbon dating and rock dating- Nuclear fission: mechanism, atom bomb and nuclear reactor- Nuclear fusion: mechanism by carbon cycle method and proton – proton chain method, hydrogen bomb

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I, II, IV & V	Principles of Inorganic Chemistry	B. R. Puri, L. R. Sharma, and K. C. Kalia	Milestone publications, 33 rd ed., 2015
I, II, IV & V	Satya Prakash's Modern Inorganic Chemistry	R. D. Madan	S. Chand and Sons publications, 3 rd ed., 2014
I, II, IV & V	Text book of Inorganic Chemistry	P. L. Soni and Mohan Katyal	S. Chand and sons publications, 20 th ed., 2013
III	Instrumental methods of chemical analysis	H. Kaur	Pragathi Prakasan publications, 6 th ed., 2006
I, II, IV & V	Advanced Inorganic Chemistry (Volume I)	Satyaprakash, G. D. Tuli, S.K Basu, and R. D. Madan	S. Chand and Sons publications, 5 th ed., 2013.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Inorganic Chemistry- Principles of structure and reactivity	J. E. Huheey, E. A. Keiter, R. L. Keiter and O.K. Medhi	Pearson education Ltd., 4 th ed., 2012
2.	Basic inorganic Chemistry	F. Albert Cotton, Geoffery Wilkison, and Paul.L. Gaus	Wiley India Pvt., Ltd., 3 rd ed., 2012
3.	Inorganic Chemistry	Peter Atkins, Tina Overton and Jonathon Rourke	Oxford university press, 4 th ed., 2012
4.	Vogel's Textbook of quantitative analysis	J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, and B. Sivasankar	Pearson Education Ltd., 6 th ed., 2011
5.	Engineering Chemistry	P.C. Jain and Monika Jain	Dhanpat Rai Publications, 15 th ed., 2013.

E-Resources: (Web resources & E-books)

- <http://www.chemeddl.org/resources/pt/>
- <http://www.chemeddl.org/resources/biographies/>
- <http://www.chemeddl.org/resources/glossary/>
- <https://chemistry.com.pk/books/concise-inorganic-chemistry-jd-lee/>
- <https://chemistry.com.pk/books/shriver-atkins-inorganic-chemistry-5e/>
- <https://nptel.ac.in/courses/103106101/>
- <https://www.slideshare.net/raiuniversity/b-sc-i-chemistry-i-u-i-nuclear-chemistry-a>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's Taxonomy level
CO 1	M	-	L	-	M	M	A
CO 2	H	M	M	M	M	M	A
CO 3	H	L	M	-	M	M	A

Content Delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Flip class room
- Seminar
- Video
- Visual aids
- Charts and posters
- Models
- ICT-open source
- Problem solving
- Peer teaching

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Online test	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Online test	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either Or type - 5 Questions	(5 X 4= 20 marks)
Section C	Either Or type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Online test (4)
R	30 %	30 %	Overall Structure: 25% (1 mark)	30%
U	40 %	40 %	Content : 50% (2 marks)	40%
A	30 %	30 %	Presentation : 25% (1 mark)	30%

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10) MCQ										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory; P-Problems									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20					
	A	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	
I	✓	✓									T	T					T	T							
II			✓	✓								T	T					T	T						
III					✓	✓							T	T					T	T					
IV							✓	✓						T	T						T	T	P		
V								✓	✓							T	T						T	T	P

Course Designed by	Mrs. V. Anitha	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department:	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – V

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core VII Physical Chemistry I	Course Code: 517C07
Semester: V	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T:Tutorial)

Course Objectives:

- To recognize and understand the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another.
- To understand implications of the second law of thermodynamics and limitations placed by the second law on the performance of thermodynamic systems.
- To describe the equilibria existing between different states of matter and the interplay between the rate of reaction and the magnitude of the equilibrium constant for reversible chemical reactions.
- To develop an understanding of physico-chemical knowledge within the area of surface and colloid chemistry.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Execute the basic concepts and laws of thermodynamics.	A
CO2	Apply thermo chemistry principles and discuss the concepts of enthalpy and entropy	A
CO3	Develop a competent knowledge in thermodynamic principles and solve the problems in pertaining area of study.	A
CO4	Specify the Le-Chatelier principle and Law of mass action and apply them to any given equilibrium reaction.	A
CO5	Explain the fundamental concepts in colloidal chemistry and surface chemistry and apply knowledge of adsorption isotherm to interpret Langmuir and B.E.T theory of adsorption.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Thermodynamics - I

(11 Hours)

Definition of terms – systems, surroundings, macroscopic properties, state variable, thermodynamic equilibrium, intensive and extensive properties, isothermal, adiabatic, isobaric, isochoric, reversible and irreversible reactions-exact and inexact differentials- zeroth law of

thermodynamics and its significance- statement of first law of thermodynamics - internal energy and enthalpy- heat capacity of a system C_p and C_v and relation between them- calculation of q , w , dE & dH for an ideal gas under isothermal conditions for reversible processes.

Unit II: Thermochemistry**(8 Hours)**

Thermo chemistry: Hess's law of constant heat of summation, enthalpy of reaction, combustion, neutralisation, solution and formation- Relation between enthalpy of a reaction at constant volume and at constant pressure- Variation of enthalpy of a reaction with temperature (Kirchhoff's equation)-Measuring the enthalpy of combustion-Bomb calorimeter.

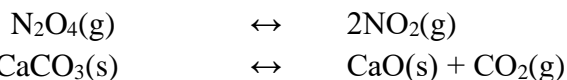
Unit III: Thermodynamics - II**(15 Hours)**

Second law of thermodynamics- Limitations of 1st law and need for 2nd law- Different statements of II law of thermodynamics- Carnot cycle, Carnot theorem and efficiency of a heat engine- Thermodynamic scale of Temperature- Concept of entropy- Entropy change in an isothermal expansion of an ideal gas- Entropy changes of an ideal gas in isothermal, isobaric and isochoric process- Entropy of mixing of ideal gases-Concept of work function, free energy and enthalpy- Definition of A & G , physical significance of A & G - Temperature and pressure dependence of A & G - Gibbs – Helmholtz equation- Concept of chemical potential – Gibbs Duhem equation- Clapeyron- Clausius equation.

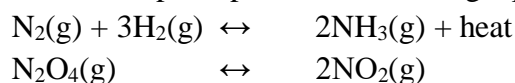
Third law of thermodynamics-statement -Nernst heat theorem - Determination of absolute entropies of solid, liquid and gases- exceptions of third law.

Unit IV: Chemical Equilibrium**(9 Hours)**

Chemical equilibrium- nature of chemical equilibrium- law of mass action- Van't Hoff's reaction isotherm-thermodynamic derivation of law of chemical equilibrium- equilibrium constants - Relation between K_p , K_c and K_x -Temperature dependence of chemical equilibrium constant - Pressure dependence of chemical equilibrium constant- Homogeneous equilibrium- Heterogeneous equilibrium- Le-Chatelier principle –Application of Law of mass action to the following equilibria



and Application of Le-Chatelier principle to the following equilibria

**Unit V: Colloidal Chemistry and Surface Chemistry****(9 Hours)**

Colloids - Introduction- classification- preparation: electrical dispersion and peptization- purification - properties: optical properties, electrophoresis and electro-osmosis - gold number- applications - surfactants, emulsion and gels (preliminary idea only).

Adsorption - Introduction- physisorption and chemisorption- application- -adsorption of

gases by solids- Factors influencing adsorption - types of adsorption isotherms- Langmuir and B.E.T theory of adsorption.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Text book of Physical Chemistry	B. R. Puri, L. R. Sharma and S. P. Madhan	Vishal publications, 47 th ed., 2015.
	Essentials of Physical Chemistry	Arun Bahl, G. D. Tuli and B. S. Bahl	S. Chand and sons publications, 5 th ed., 2014.
I and III	Engineering Chemistry	P.C. Jain and Monika Jain	Dhanpat Rai Publications, 15 th ed., 2013.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Atkins' Physical Chemistry	Peter Atkins, and Julio De Paula,	Oxford university press, 9 th ed., 2013.
2.	Textbook of physical chemistry	Samuel Glasstone	Macmillan India publications, 1 st ed., 1971.

E-Resources : (Web resources & E-books)

- <https://www.khanacademy.org>
- <https://www.learnthermo.com/T1-tutorial/ch01/intro.php>
- <http://www.learncheme.com/screencasts/thermodynamics>
- <https://nptel.ac.in/courses/122101001/>
- <http://www.freebookcentre.net/>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	H	M	L	M	M	M	A
CO 2	H	M	L	M	M	M	A
CO 3	H	M	L	M	M	M	A
CO 4	H	M	L	M	M	M	A
CO5	H	M	L	M	M	M	A

Content Delivery Methods (Minimum Two):

- Lecture Method
- Demonstration Class
- PPT and Video
- Open Source
- Open Book Assignment

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Group discussion / Seminar	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Group discussion / Seminar	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Group discussion / Seminar (4)
R	30%	30%	Overall Structure: 25% Content : 50% Presentation :25%	Presentation: 50% (2 Marks) Content : 25% (1 Mark) Interaction/overall Effort :25% (1 Mark)
U	40%	40%		
A	30%	30%		

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)										Section C (5 x 9 = 45) T-Theory; P-Problems									
	MCQ																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20										
I	✓	✓									T	T									T	T								
II			✓	✓								T	T									T	T	P						
III					✓	✓							T	T	P								T	T						
IV							✓	✓							T	T									T	T	P			
V									✓	✓						T	T											T	T	

Course Designed by	Dr. J. Bhuvaneshwari
Course Reviewed by	Mrs. M. Malarvizhi
Head of the Department	Mrs. M. Malarvizhi

B. Sc Chemistry Semester – V

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Elective I Polymer and Dye Chemistry	Course Code: 517CE1
Semester: V	No. of Credits: 4
No. of hours : 60	C:T: 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T:Tutorial)

Course Objectives:

- To understand the importance of industrial polymers and their classification
- To acquire the knowledge about the polymerization techniques and polymer processing
- To learn the scientific and chemical principles underlying in dye chemistry
- To understand the importance of dyes and their classification

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Account the general structure of polymers, differentiate between natural and man-made polymers, give examples for everyday and industrial application of polymers.	A
CO2	Execute the various polymerization methods, discuss the different polymerization mechanisms and the characterisation methods.	A
CO3	Demonstrate the polymer fractionation methods and Illustrate the methods for the determination of the molecular weight	A
CO4	Analyze the fundamentals involved in the dye chemistry, and to classify the types of dyes on the basis of application	A
CO5	Predict the synthetic methods for some specific dyes and apply the knowledge of dye chemistry in various industry.	A

R-Remembrance, U –Understanding, A-Apply

Syllabus:

Unit I: Classification of Polymers

(11 Hours)

Introduction- polymerization functionality- degree of polymerization- classification of polymers- elastomers, fibres, thermosetting and thermoplastic polymers- methods of polymerization: bulk, solution, suspension and emulsion- polymer processing techniques: calendaring, compression, extrusion and injection moulding, film casting, and foaming.

Unit II: Polymerization Mechanism and Special Polymers

(11 Hours)

Chain polymerization: mechanism of free radical and ionic polymerization- Co-

ordination polymerization: illustration and mechanism using Zeigler-Natta catalyst- tacticity-factors influencing stereo regulation- glass transition temperature- flow temperature- melting temperature- factors affecting T_g - manufacture, properties and uses of typical polymers: polyethylene, polystyrene, polyesters, PVC, PET, nylon 6, nylon 66, phenolic resins and Teflon.

Unit III: Fractionation and Molecular Weight Determination (10 Hours)

Characterization of polymers- Polymer fractionation: introduction, fractional precipitation method and gel permeation chromatography- Average molecular weights: introduction and types of average molecular weights- molecular weight- determination by light scattering, viscosity and ultra centrifuge method.

Polymer reactions: addition- substitution- cyclisation- cross linking- vulcanization.

Unit IV: Dye Chemistry I (10 Hours)

Requisites of a dye- colour and constitution – theories of colour and constitution: Witt theory, quinonoid theory- classification of dyes according to application- chemical classification of dyes- Pigments: requirements- classification- difference between dyes and pigments.

Nitro and nitroso dyes: synthesis, properties, uses of naphthol green Y, disperse yellow, picric acid and martius yellow- Azo dyes: mechanism of diazotization and coupling reaction- preparation and uses of butter yellow, para red, bismark brown and congo red- Di and triphenyl methane dyes: auramine-O, malachite green, and crystal violet.

Unit V: Dye Chemistry II (10 Hours)

Acridine dyes: proflavin and acriflavin- cyanine, isocyanine and carbocyanine dyes: Synthesis and uses of quinoline blue, ethyl red and sensitol red- Phthalocyanine dyes: introduction, general methods of preparation and applications of metal phthalocyanine- non-textile uses of dye stuffs: leather, paper, food colours, medicine, photography and cosmetics- pollution due to dyeing industry effluents and its remedial measures- dye effluents treatment using green methodology.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - III	Polymer science	V. R. Gowariker, N. V. Viswanathan, and Jayadev Sreedhar	New Age International Pvt., Ltd. publications, 2 nd ed., 2015.
IV - V	Synthetic Dyes	R. Chatwal	Himalayan publications, 4 th ed., 2016.
I - V	Industrial Chemistry	B.K. Sharma	Goel publications, 12 th ed., 2016.
IV-V	Modern Organic Chemistry	M. K. Jain and S. C. Sharma	Vishal Publications, 4 th ed., 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Text book of Polymer	F. W. Billmeyer, and Jr.	Wiley and Sons publications, 3 rd

	Science	John	ed., 2015.
2.	Introductory Polymer Science	G. S. Mishra	New Age International Pvt., Ltd. publications, 1 st ed., 1993.
3.	A Text book of Synthetic Dyes	O.D. Tyagi and M.Yadav	Anmol publications, 5 th ed., 2001

E-Resources : (Web resources & E-books)

- www.youtube.com/watch?v=LBCrSbcoL9g
- [faculty.kfupm.edu.sa/CHEM/belali/CHEM 456/Chapter 8...](http://faculty.kfupm.edu.sa/CHEM/belali/CHEM%20456/Chapter%208...)
- www.slideshare.net/amirhamza1234/presentation-on-dye
- www.authorstream.com/Presentation/...polymerization-ppt
- monographs.iarc.fr/wp-content/uploads/2018/06/...
- nptel.ac.in/courses/104105039
- www.slideshare.net/NehaKumar09/impact-of-the-dye...
- web.mit.edu/5.33/www/lec/poly.pdf
- nptel.ac.in/courses/103103029/pdf/mod7.pdf

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	H	L	L	M	M	L	A
CO 2	H	L	L	M	M	L	A
CO 3	H	L	L	M	M	L	A
CO 4	H	L	L	M	M	L	A
CO5	H	L	L	M	M	L	A

Content Delivery Methods (Minimum Two):

- Lecture Method
- Demonstration Class
- PPT and Video
- ICT Enabled Class
- Guest Lecture

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Internship	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Internship	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Internship (4)
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50% (2 Marks) Presentation : 25% (1 Mark)	Report - 50 % (2 Marks) Viva Voce - 50% (2 Marks)
U	40%	40%		
A	30%	30%		

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)					Section C (5 x 9 = 45)														
	MCQ										11		12		13	14		15		16		17		18		19		20		
	1	2	3	4	5	6	7	8	9	10	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b		
I	✓	✓									T	T							T	T										
II			✓	✓									T	T							T	T								
III					✓	✓									T	T							T	T						
IV							✓	✓									T	T							T	T				
V								✓	✓										T	T							T	T		

Course Designed	Dr. M. Indrani	
Course Reviewed	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – V

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Elective I Agro Industrial Chemistry	Course Code: 517CE2
Semester: V	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T : Tutorial)

Course Objectives:

- To learn the scientific and chemical principles underlying in water chemistry
- To acquire knowledge about physical and chemical aspects of soil.
- To understand the chemistry of plant nutrients
- To impart basic knowledge in pesticides, insecticides and herbicides

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Demonstrate different water softening and treatment methods	U
CO2	Evaluate different types of physico-chemical properties of water and soil	U
CO3	Describe the components, classification of soil, factors controlling soil reactions and soil colloids	U
CO4	Discuss the manufacture, different types of plant nutrients, fertilizers, pesticides, insecticides and herbicides	U
CO5	Investigate the safe handling of fertilizers, pesticides, insecticides and herbicides	A
CO6	Critique the environmental impact of using fertilizers, pesticides, insecticides and herbicides	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I – Water Treatment

(10 Hours)

Hardness of water - units of hardness - Equivalence of CaCO_3 - Water softening methods – lime soda process, permutit and ion exchange process - Water quality analysis - Determination of hardness of water, acidity, alkalinity, pH value, chloride content and their estimations - Dissolved oxygen demand (DO), Biological oxygen demand (BOD), chemical oxygen demand (COD) and their determination - Water treatment - Primary, Secondary and Tertiary and dialysis, Desalination and reverse osmosis.

Unit II – Soil Chemistry I**(10 Hours)**

Soil and soil components - definition of soil, major soil components – mineral matter, organic matter, soil water and soil air. Classification of Soil- Modern classification and seventh approximation. Physical properties of soil. Soil texture – definition, classification and characteristics. Soil structure – definition, types and management. Soil porosity – definition and factors affecting porosity. Soil temperature – sources of soil heat, factors affecting soil temperature, regulation of soil temperature. Role of physical properties in soil fertility.

Unit III - Soil Chemistry II**(10 Hours)**

Soil colloids - Introduction - Properties of colloids- Brownian movement, flocculation, electrical charge, adsorption. Soil reactions - Soil pH, buffer action and its importance in agriculture. Factors controlling soil reactions. Buffer action and its importance in agriculture - Ion exchange reactions – definition, exchange capacity of cations and anions and their importance. Nature of soil - Acid and alkaline soil- classification, cause for formation and methods for reclamation.

Unit IV– Nutrients for Plants**(11 Hours)**

Plant nutrients - macro and micro nutrients - their role in plant growth - sources - forms of plants nutrient absorbed by plants - factors affecting nutrient absorption - deficiency symptoms in plants - corrective measures - chemicals used for correcting nutritional deficiencies. Fertilizer - Introduction - requisites of fertilizers. Nitrogenous fertilizer – manufacture and uses of NH_4NO_3 , urea and calcium cyanamide. Phosphate fertilizer – preparation and uses of super phosphate of lime and triple super phosphate. Potash fertilizer – preparation and uses of KCl and KNO_3 . Bio fertilizers – definition, precautions and merits - Soil pollution by fertilizer.

Unit V – Pesticides, Insecticides and Herbicides**(11 Hours)**

Pesticides - definition and classification on the basis of types of pests - one example in each case (preparation not necessary) - safe handling of pesticides - impact of pesticides on soil, plants and environment - synthesis and uses of pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil) , Anilides (Alachlor and Butachlor). Insecticides - definition and classification - Parathion, Dithion and Aldrin. Herbicides - definition, classification - mechanism of action - arsenic, nitro compounds and chloro compounds. Acaricides - rodenticides - attractants – repellants- green alternatives for pesticides, insecticides and herbicides.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Industrial chemistry	B.K. Sharma	Goel publications, 12 th ed., 2016
I-V	Plant ecology and soil science	R. S Shukla, and P. S. Chandel	S. Chand and Sons publications, 1 st ed., 1998.

I-V	Soil at glance	U.N. Sahai	Kalyani publications, 1 st ed., 2004
I-V	Industrial Chemistry	M. G. Arora and M. Singh	Anmol Publications, Volume I and II, 1 st ed., 1994

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Reigel's Hand book of Industrial Chemistry	James A. Kent	CBS publications, 9 th ed., 1997
2.	Principles of soil science	M. M. Rai	Macmillan India Limited publications, 1 st ed., 1988

E-Resources : (Web resources & E-books)

- https://www.acehsc.net/wpcontent/uploads/Industrial_Chemistry_by_Rohan_Barar.pdf
- <https://nptel.ac.in/courses/103107082/7>
- <https://nptel.ac.in/courses/103107086/>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Cognitive levels
CO 1	H	-	M	M	M	M	U
CO 2	H	-	M	M	M	M	U
CO 3	H	-	M	M	M	M	U
CO 4	H	-	M	M	M	M	U
CO 5	H	-	M	M	M	M	A
CO 6	H	-	M	M	M	M	A

Content delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Video
- Hands-on-training
- Demonstration
- Practical session
- Charts and posters
- Industrial visits/Field visits

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Group discussion Seminar	Course Exit Survey

Internal Assessment components:

Components	CIA	Group discussion	Seminar	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Group discussion (4)	Seminar (4)
R	30%	30%	Presentation: 50% (2 Mark)	Presentation: 50% (2 Mark)
U	40%	40%	Content : 25% (1 Mark)	Content : 25% (1 Mark)
A	30%	30%	Interaction/ overall Effort :25%(1 Mark)	Interaction/ overall Effort :25%(1 Mark)

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)										Section C (5 x 9 = 45) T-Theory; P-Problems																																							
	MCQ										11					12					13					14					15					16					17					18					19					20				
	1	2	3	4	5	6	7	8	9	10	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b																						
I	✓	✓									T	T											T	T																																				
II			✓	✓									T	T											T	T																																		
III					✓	✓									T	T											T	T																																
IV							✓	✓									T	T																		T	T																							
V								✓	✓										T	T																		T	T																					

Course Designed by	Mrs. M. Malarvizhi	
Course Reviewed by	Mrs. S. Umadevi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – V

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Elective II Project	Course Code: 517CE3
Semester: V	No. of Credits: 4
No. of hours : 60	P:T: 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(P: Practical hours, T: Tutorial)

Course Objectives:

- To think critically and analyze chemical problems.
- To enhance the ability of working in teams as well as independently.
- To perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions.
- To present scientific and technical information resulting from laboratory experiments both in written and oral formats.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Develop experimental skills and to apply these skills to the project task.	A
CO2	Identify procedures to search for and read the latest chemical literature.	U
CO3	Build the skills to communicate effectively and to present ideas clearly and coherently in both the written and oral forms.	A
CO4	Recognize the effective use of the library and other information resources in chemistry, including the primary literature, tabulated data, and secondary sources such as the internet.	U

R-Remembrance U –Understanding A-Apply

Instructions:

1. Students are allotted to various faculties of the department according to their CGPA and / or choice. They will be working on specialized problem related to the research interests of the respective guides.
2. Group size: Maximum 3
3. Review I - Evaluated at the end of I CIA
Review II - Evaluated at the end of II CIA

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Basic Principles of Practical Chemistry	V. Venkateswaran, R. Veeraswamy, and A. R. Kulandaivelu	S. Chand and Sons publications, 2 nd ed., 2016.

2.	Advanced Practical Chemistry	Raghupati Mukhopadhyay and Pratul Chatterjee	Books and Allied publications, 3 rd ed., 2007.
3.	Vogel's Text Book of Practical Organic Chemistry	B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell	Pearson Edn., Ltd., 5 th ed., 2009.

E-Resources : (Web resources & E-books)

- chem.psu.edu/undergrad/reu/participating-faculty-research-projects
- www.thoughtco.com/chemistry-projects-4133589
- www.thoughtco.com/chemistry-projects-4133589
- <https://www.lib.uoguelph.ca/get-assistance/writing/specific.../writing-literature-review>
- <https://www.ugc.ac.in/journalist/>
- www.e-journals.in/
- www.niscair.res.in/sciencecommunication/researchjournals/rejour/ijcb/ijcb0.asp
- www.niscair.res.in/sciencecommunication/researchjournals/rejour/ijca/ijca0.asp
- ijep.co.in/
- https://www.annauniv.edu/academic_courses/docs/ugthesis.pdf

Mapping of Course outcome with Pos

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	M	M	M	M	H	M	A
CO 2	M	M	M	M	H	M	U
CO 3	M	M	M	M	H	M	A
CO 4	M	M	M	M	H	M	U

Content Delivery Methods (Minimum Two):

- Workshops
- Hands-on-training
- Demonstration
- Practical session
- Industrial/Instrumentation visits
- Open source
- Problem solving
- Peer teaching
- Scientific thinking

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Dissertation Presentation Viva Voce	Course Exit Survey

Internal Assessment components:

Bloom's Category	CIA I (review)	CIA II (review)	Total
A	10	15	25

ESE Assessment components:

Dissertation	Presentation	Viva Voce	Total
40	10	25 (Questions from CO1, CO2, CO3, & CO4)	75

Evaluation of the Project

No	Main component	Total Marks	Sub components	Marks
1.	Dissertation	10	Introduction, Review and Objectives	Excellent : 10 Very Good: 8 Good: 6 Average: 4
2.		10	Materials and methods	Excellent : 10 Very Good: 8 Good: 6 Average: 4
3.		10	Results and Discussion	Excellent : 10 Very Good: 8 Good: 6 Average: 4
4.		10	Conclusion and References	Excellent : 10 Very Good: 8 Good: 6 Average: 4
5.	Project Presentation	10	i) Clarity and understanding ii) Effective presentation iii) Time Management iv) Interaction	All four: 10 Three: 8 Two: 6 One: 4
6.	Viva- Voce	25	Understanding of i) Review ii) Objectives iii) Methodology iv) Results	All four: 25 Three: 20 Two: 15 One: 10

Course Designed by	Dr. M. Indrani	
Course Reviewed by	Mrs. S. Umadevi	
Head of the Department	Mrs. M. Malarvizhi	

B.Sc. Chemistry
Semester V

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part IV Skill Enhancement Course III Chemistry for Exploration II	Course Code: 517CS3
Semester: V	No. of Credits: 3
No. of hours : 45	C:T 39:6
CIA Max. Marks: 75	ESE Max. Marks: -

(C: Contact hours, T: Tutorial)

Course objectives

- To cultivate statistical thinking among students
- To develop skills in handling complex problems in data analysis and research design
- To distinguish between qualitative and quantitative measurements, assess the sources of error in chemical and instrumental analysis and account for errors in data analysis.
- To interpret analytical results and to develop scientific and practical skills in data analysis and to comprehend the concepts of hypothesis, sampling and calibration.
- To use Excel to conduct statistical analysis
- To provide an awareness on Intellectual Property Rights to the graduates.
- To develop understanding of the basic framework of research process.
- To identify various sources of information for literature review and data collection.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Collect, organize, apply, assess, analyze complex experimental data using statistical methods and account for different types of errors and rejection of data	A
CO2	Execute and evaluate calibration curves and linear regressions	A
CO3	Compute statistical inference in the form of confidence intervals, t-test, f-test, one-way analysis of variance and Chi-square test in chemical problems	A
CO4	Develop professional mannered data in an informative graphical representation	A
CO5	Review of literature data from print, web resources and summarize different types of intellectual property rights	A

R-Remembrance U –Understanding A-Apply

Syllabus:**Unit I: Data Analysis I (7 Hours)**

Measurement- nature of quantitative measurements - need for data analysis - errors- types of errors- minimization of errors - uncertainty in experimental techniques - absolute and relative uncertainty- The Gaussian distribution -accuracy and precision - significant numbers.

Unit II: Data Analysis II (7 Hours)

Mean, median, mean deviation, standard deviation and variance - confidence intervals and confidence limits - Linear calibration curves-regression and correlation.

Unit III: Data Analysis III (7 hours)

Test of hypothesis - t-test and f-test - rejection of data Analysis of variance- one way ANOVA– sampling techniques.

Unit IV: Handling of numeric and graphical data in spread sheet software (9 hours)

Handling numeric data: Spreadsheet software - creating a spreadsheet - entering and formatting information - basic functions and formulae - creating charts, tables and graphs- incorporating tables and graphs into word processing documents - simple calculations for statistical analysis using a spreadsheet - plotting calibration graphs using a spreadsheet -graphical solution of equations (calculation of entropy/enthalpy change from Arrhenius plot).

Numerical curve fitting - linear regression (molar extinction coefficients from absorbance data), numerical differentiation (pH metric titrations) and integration (entropy/enthalpy change from heat capacity data).

Unit V: Literature survey in chemistry research and introduction to IPR (9 Hours)

Literature Survey: Print sources of information: Primary - secondary and tertiary sources - Journals: abstracts – reviews - monographs - dictionaries - text-books. Digital sources of information: Web resources - E-journals - Hot articles - Citation index - Impact factor - H-index. E-books, Internet discussion groups and communities, Blogs, Search engines- Scirus, Google Scholar, ChemSpider, Science Direct, SciFinder, Scopus, ACS and RSC. Internet resources for chemistry. Finding and citing published information.

Intellectual Property Rights: Introduction and the need for intellectual property rights- patents - copyrights - trademarks - geographical indications- industrial designs - IP Administration in India.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-III	Instrumental methods of chemical analysis,	H. Kaur	PragathiPrakasan publications, 6 th ed., 2006.

I-V	Research Methodology- Methods & technology	C.R. Kothari	New Age International Publishers, 2 nd ed., 2004.
V	Research Methodology for biological sciences	N. Gurumani	MJP publisher, 1 st ed., 2014
I-V	Research Methodology	R. Paneerselvam	Prentice Hall of India private Ltd., 1 st ed., 2007.
V	Intellectual property rights	R. Radhakrishnan, and S.Balasubramanian	Excel books, 1 st ed., 2008.
V	Practical approach to Intellectual property rights	R. Karuppasamy, and H. C. Bindhusa.	Himalaya publishing house, 1 st ed., 2008.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Elements of analytical chemistry	R. Gopalan, P.S. Subramanian, and K. Rengarajan	Sultan chand and sons publishers, 2016
2.	Fundamental of analytical chemistry	Skoog, West, Hollerr, Crouch	Cengage learning publisher, 8 th Edition, 2012
3.	Principles of analytical chemistry	M. Valcarcel	Springer edition, 2011
4.	Analytical chemistry	U.N. Dash	Sultan chand and sons publisher, 3 rd edition, 2013.

E-Resources: (Web resources & E-books)

- <http://chemistry.com.pk/books/analytical-chemistry-by-gary-d-christian/>
- <https://chemistry.com.pk/books/skoog-principles-of-instrumental-analysis/>
- <https://www.icsi.edu/media/webmodules/publications/9.4%20Intellectual%20Property%20Rights.pdf>
- https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627956/IP-Rights-in-India.pdf
- https://edisciplinas.usp.br/pluginfile.php/2317618/mod_resource/content/1/BLOCO%202_Research%20Methods%20The%20Basics.pdf

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's taxonomy
CO 1	H	M	L	-	M	M	A
CO 2	H	M	L	-	M	M	A
CO 3	H	M	L	-	M	M	A
CO 4	H	M	M	-	M	M	A
CO 5	H	M	M	-	M	M	A

Content Delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Video
- Practical session
- ICT-open source
- Peer teaching
- Hands-on training
- Problem solving
- Computational thinking

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Review	Course Exit Survey

Internal Assessment components:

Components	CIA I	CIA II	Assignment	Review	Total
Marks	30	30	8	7	75

Question Paper Pattern

Section A	Either or Type - 5 Questions (5 x4 = 20 Marks)
Section B	Either or Type - 5 Questions (5 x 8 =40 Marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (60)	CIA II (60)	Assignment (8)	Review (7)
R	30%	30%	Overall Structure: 25% (2 Marks)	Report - 50% (3.5 Marks)
U	40%	40%	Content : 50% (4 Marks)	Presentation and Viva Voce -
A	30%	30%	Presentation : 25% (2 Marks)	50% (3.5 Marks)

Course Designed by	Mrs. M. Malarvizhi	
Course Reviewed by	Mrs. S. Umadevi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – VI

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core VIII Organic Chemistry II	Course Code: 617C08
Semester: VI	No. of Credits: 5
No. of hours : 75	C:T 65:10
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T:Tutorial)

Course Objectives:

- To recognize the importance of sources, properties and structure of simple carbohydrates and vitamins.
- To gain an understanding of the classification, properties and structure of proteins, amino acids and hormones.
- To create interest on the biological importance, classification and structure of natural products like alkaloids, terpenoids and steroids.
- To insist the significance of the study of various diseases and their remedial drugs such as analgesics, antipyretics, antibiotics, anti malarial and anticonvulsant agents.
- To equip the students with the knowledge about drugs like anaesthetics, antioxidants, antidiabetics, antiseptic and sulpha drugs

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Analyse the structure, preparation, properties and vitality of carbohydrates, vitamins and problems related to deficiency of Vitamins.	A
CO2	Assess the classification of proteins, amino acids and hormones and examine its structure, properties and functions.	A
CO3	Discover the biological importance of alkaloids, terpenoids and steroids and illustrate the structural interpretation of various alkaloids and terpenoids.	A
CO4	Interpret the terms used in drug chemistry, Investigate the causes and symptoms of various diseases, their preventive measures and mode of action of drugs(antipyretics, analgesics, antibiotics) synthesis and uses of some specific drugs	A
CO5	Report the drugs used as anesthetics, anti-septics, anti-oxidants, sulpha drugs and anti-diabetics.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Carbohydrates and Vitamins

(13 Hours)

Introduction and classification of carbohydrates- Monosaccharide: Preparation, properties and uses of glucose and fructose- Structural elucidation of glucose (open and ring structure) Inter conversion of glucose to fructose and vice versa- Killiani- Fischer synthesis and Ruff-degradation- Mutarotation and epimerization.

Disaccharides- Introduction- Sucrose- manufacture, properties and uses

Polysaccharides- Introduction- Starch - manufacture, properties and uses. (Elucidation of structure not necessary)- Cellulose: Preparation, properties and uses- derivatives of cellulose (cellulose nitrate and acetate)

Vitamins: Introduction and classification- Sources, deficiency diseases and importance of vitamins- Structure and synthesis of retinol, ascorbic acid and pyridoxine.

Unit II: Proteins, Aminoacids and Hormones (13 Hours)

Proteins- Analytical tests- Classification of proteins according to structure, physical properties and function- Primary, secondary and tertiary structure of proteins (elementary idea only).

Aminoacids- Introduction and classification of amino acids- Preparation, properties and uses of glycine and alanine- Peptides and polypeptides: Introduction- Synthesis of polypeptide by Bergman method, Merrifield method- End group degradation- C- terminal analysis (reductive and Hydrazinolysis method)- N- terminal analysis (Sanger's method and Edman's method), Nucleic acids-Structure and functions of DNA and RNA.

Hormones: Introduction and classification of hormones- functions of Insulin, Adrenaline, and Thyroxine.

Unit III: Alkaloids and Terpenoids (15 Hours)

Alkaloids: Introduction and classification of alkaloids- General methods of extraction of alkaloids- General methods of determination of functional groups- nature of oxygen and nitrogen functions , estimation of methoxy group: Zeisel's method, degradation by Hoffman's exhaustive methylation- Structural elucidation and synthesis of Piperine, Conine, and Papaverine.

Terpenoids- Introduction- isolation and classification of terpenes- Isoprene and special isoprene rule- Structural elucidation and synthesis of geranial, α -terpineol, and α -pinene.

Steroids- Definition- Classification and biological importance- Structure of Cholesterol (Structural elucidation not necessary).

Unit IV: Drug Chemistry I (12 Hours)

Drug – definition of the following terms: drug, pharmacology, toxicology, chemotherapy, bacteria, virus, LD₅₀, ED₅₀ and therapeutic index- Routes of drug administration- excretion of drugs- Causes, symptoms and treatment of tuberculosis, jaundice, typhoid, malaria, and Cholera.

Analgesics and antipyretics- Introduction and mode of action- synthesis and uses of aspirin and paracetamol- antibiotics- Introduction- mode of action- structure and uses of penicillin, streptomycin, chloramphenicol and tetracycline (synthesis and structural elucidation not necessary).

Anti malarial- Introduction and classification- synthesis and uses of chloroquine and primaquine- anticonvulsant agents- Introduction, structure and uses of phenobarbitone and diphenyl hydantoin.

Unit V: Drug chemistry II**(12 Hours)**

Sulpha drugs- Introduction and classification- Mode of action of sulpha drugs- Synthesis and uses of sulphanilamide, sulphathiazole and sulpha pyridine- Antiseptic and disinfectant- Introduction and distinction between antiseptic and disinfectant- Phenolic compounds – ingredients and uses of lysol and dettol- Anaesthetics- Introduction, characteristics and classification- Volatile anaesthetics: preparation, properties and uses of ether, chloroform, N₂O- Intravenous anaesthetics - structure, function and uses of thiopental sodium- Local anaesthetics – sources, structure and uses of cocaine- Antioxidants: Introduction and uses- Antidiabetics: causes- hyper and hypo glycaemic drugs

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – III	Organic chemistry of natural products	Gurdeep Chatwal	Himalaya publications, Volume I and II, 3 rd ed., 2016.
I -III	Modern Organic Chemistry	M. K. Jain and S. C. Sharma	Vishal Publications, 4 th ed., 2016.
I-III	Bio chemistry	Dulsy Fatima	Saras publications, 5 th ed., 2015.
IV and V	A text of pharmaceutical chemistry	Jayashree ghosh	S. Chand and Sons publications, 1 st ed., 1997.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Chemistry of organic natural products	O.P. Agarwal	Goel publications, Volume I and II, 1999.
2.	Synthetic drugs	Gurdeep R . Chatwal	Himalaya publications, 2 nd ed., 2009

E-Resources : (Web resources & E-books)

- <http://www.freebookcentre.net/>
- <http://semmelweis.hu/farmakognozia/files/2015/11/Terpenoids-2015-11.pdf>
- <https://www.scienceprofonline.com/microbiology/mode-of-action-of-sulfonamide-antibiotics-2.html>
- <https://www.biologyexams4u.com/2011/10/protein-structure.html#XAQOVtsza1s>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	H	M	L	L	L	L	A
CO 2	H	M	L	L	L	L	A
CO 3	H	L	-	-	L	L	A
CO 4	H	L	L	M	M	M	A
CO 5	H	L	L	M	M	M	A

Content Delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Flip class room
- Seminar
- Video
- Visual aids

- Charts and posters
- Models
- Demonstration
- Open source
- Problem solving
- Peer teaching

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Seminar	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Seminar	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Seminar (4)
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50% (2 Marks) Presentation :25% (1 Mark)	Presentation: 50% (2 Marks) Content : 25% (1 Mark) Interaction/overall Effort :25% (1 Mark)
U	40%	40%		
A	30%	30%		

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory														
	MCQ																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20										
I	✓	✓									T	T									T	T								
II			✓	✓								T	T									T	T							
III					✓	✓							T	T									T	T						
IV							✓	✓						T	T										T	T				
V									✓	✓																	T	T		

Course Designed by	Mrs. S. Umadevi	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B.Sc. Chemistry Semester VI

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core IX Inorganic Chemistry II	Course Code: 617C09
Semester: VI	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T: Tutorial)

Course Objectives:

- To learn the general characteristics of d and f block elements
- To understand the basics and theories of coordination compounds.
- To understand the preparation, properties and structure of carbonyls & nitrosyl compounds
- To know the role of alkali, alkaline and transition metal ions in primary bioinorganic systems
- To learn the basic principles and applications of magnetic properties

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Employ the d and f block elements to compare their characteristics and uses	A
CO2	Discuss and apply the various theories and isomerism of coordination complexes in different fields and interpret the name, structure, magnetic properties of any coordination complexes.	A
CO3	Employ the role of alkali, alkaline and transition metals in biological systems	A
CO4	Enumerate and apply the Electrical properties and various types of magnetic properties of the compounds	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I :d and f Block Elements	(11 Hours)
<p>d-block elements: Introduction- occurrence- characteristics of transition metals: electronic configuration, ionization energy, metallic character, ionic radii, oxidation states, colour, catalytic property and magnetic property.</p> <p>f- block elements: Lanthanides: Position of lanthanides in the periodic table- general characteristics of lanthanides- Lanthanide contraction and its consequences on post lanthanide elements- Separation of lanthanides: ion exchange method- uses of lanthanides and their compounds.</p> <p>Actinides: Position of actinides in the periodic table- General characteristics of actinides- Extraction of Thorium from monazite sand and Uranium from pitch blende- Similarities and</p>	

dissimilarities between lanthanides and actinides.

Comparison of d- block elements and f- block elements.

Unit II: Co-ordination Chemistry I

(11 Hours)

Introduction- double salt, co-ordination compounds- definition and terminology: co-ordination complex, central ion, ligand, co-ordination number, co-ordination sphere, charge on complex ion- classification of ligands- Werner's theory - Nomenclature of co-ordination compounds- Sidgwick's effective atomic number- Pauling's valence bond theory- Interpretation of properties of the following complexes: $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{CoF}_6]^{3-}$, $[\text{Ni}(\text{CO})_4]$ and $[\text{CuX}_4]^{2-}$ - chelate formation- applications in analytical chemistry, softening of water, medicine and living systems.

Unit III: Co-ordination Chemistry II

(10 Hours)

Isomerism: structural isomerism- stereoisomerism: Geometrical isomerism in square planar and octahedral complexes - optical isomerism in tetrahedral and octahedral complexes- Crystal field theory: elementary treatment, splitting of d- orbitals in tetrahedral, square planar and octahedral complexes - Applications of CFT- comparative study of VBT and CFT- Thermo dynamic and kinetic stability- Factors affecting stability of metal complexes.

Unit IV: Carbonyls, Nitrosyls and Bioinorganic Chemistry

(11Hours)

Metal carbonyls- Preparation and properties of carbonyls of Fe, Co, Ni- bonding in carbonyls- structure of $\text{Fe}(\text{CO})_5$ and $\text{Fe}_2(\text{CO})_9$ - Nitrosyls: Bonding, Preparation, properties and structures of nitrosylchloride and sodiumnitroprusside.

Bioinorganic chemistry: Role of alkali and alkaline earth metals in biological processes- Metallophorphyrins: Structure and function Chlorophyll, haemoglobin and myoglobin and their role in biological system- Metalloenzymes:Carboxy peptidase 'A'- Structure and function- Biological function and toxicity of Mn, Co, Cr, Ni, Cu, Hg, Pb, Fe and Zn- Carbon monoxide and cyanide poisoning.

Unit V: Electrical and Magnetic Properties

(9 Hours)

Electrical properties: Polarisability- atomic, electronic and orientation polarization - Clausius- Mosotti equation- Polar and non polar molecules- dipole moment and ionic character- determination of dipole moment and its applications. Meaning of the terms: magnetic susceptibility, magnetic moment, diamagnetism, paramagnetism, ferromagnetism, anti ferromagnetism and ferrimagnetism- Determination of magnetic susceptibility by Gouy method.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-IV	Selected topics in inorganic chemistry	U. Malik. G.D Tuli and R.D. Madan	S. Chand and Sons publications, 8th ed., 2016

I-V	Principles of Inorganic Chemistry	B. R. Puri, L. R Sharma, and K. C. Kalia	Milestone publications, 33 rd ed., 2014
IV	Bioinorganic chemistry	Asim. K. Das	Books and allied Pvt. Ltd., 1 st ed.,2016
I-IV	Concise Coordination Chemistry	R. Gopalan and V. Ramalingam	Vikas Publications, 1 st ed., 2014
I-V	Advanced Inorganic Chemistry	Satyaprakash, G. D. Tuli, S.K Basu, and R. D. Madan	S. Chand and Sons publications, Volume II, 2012.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Inorganic Chemistry- Principles of structure and reactivity	J. E. Huheey, E. A. Keiter, R. L. Keiter and O.K. Medhi,	Pearson education Ltd., 4 th ed., 2012.
2.	Basic inorganic Chemistry	F. Albert Cotton, Geoffery Wilkison, and Paul.L. Gaus	Wiley India Pvt., Ltd., 3 rd ed., 2012
3.	Inorganic Chemistry	Peter Atkins, Tina Overton and Jonathon Rourke	Oxford university press,4 th ed., 2012.

E-Resources: (Web resources & E-books)

- <http://www.chemeddl.org/resources/pt/>
- <http://www.chemeddl.org/resources/biographies/>
- <http://www.chemeddl.org/resources/glossary/>
- <https://chemistry.com.pk/books/concise-inorganic-chemistry-jd-lee/>
- <https://chemistry.com.pk/books/shriver-atkins-inorganic-chemistry-5e/>
- <https://epgp.inflibnet.ac.in/view.php?category=666>
- https://www.nsf.gov/news/special_reports/chemistrynow/chem_green.jsp
- https://www.nsf.gov/news/special_reports/chemistrynow/chem_changingleaves.jsp

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's taxonomy
CO 1	H	-	L	-	M	M	A
CO 2	H	L	M	-	M	M	A
CO 3	H	-	M	-	M	M	A
CO 4	H	L	M	-	M	M	A

Content Delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Flip class room
- Seminar
- Visual aids
- Charts and posters
- Models
- Demonstration
- Open source

- Problem solving
- Peer teaching

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Quiz	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Quiz	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Quiz (4)
R	30 %	30 %	Overall Structure:25% (1 Mark)	30%
U	40 %	40 %	Content :50% (2 Marks)	40%
A	30 %	30 %	Presentation : 25%(1 Mark)	30%

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory; P-Problems										
	MCQ										11	12	13	14	15	16	17	18	19	20						
	1	2	3	4	5	6	7	8	9	10	a	b	a	b	a	b	a	b	a	b	a	b	a	b		
I	✓	✓									T	T							T	T						
II			✓	✓									T	T							T	T & P				
III					✓	✓								T	T							T	T & P			
IV							✓	✓								T	T							T	T	
V									✓	✓															T	T

Course Designed by	Mrs. V. Anitha	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – VI

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core X Physical Chemistry II	Course Code: 617C10
Semester: VI	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T:Tutorial)

Course Objectives:

- To learn the various concepts of electrochemistry
- Understand the concepts of non- equilibrium electrochemistry
- To learn the principles of basic analytical methods and their applications
- To learn the fundamental concepts of phase rule and its applications to one and two component systems.
- To know the various concepts of group theory

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Employ the basic knowledge of electrochemistry and related theories/Laws.	A
CO2	Explain the difference between voltaic/galvanic and electrolytic cells, apply the Nernst equation to electrochemical systems and Develop electrodes for measurement of pH and predict the redox potentials.	A
CO3	Discuss salt hydrolysis, corrosion and relate the electrochemical concepts to justify the function of batteries, fuel cells.	A
CO4	Identify and account the most appropriate electroanalytical and thermoanalytical techniques for a specific analysis and Interpret them.	A
CO5	Specify the fundamentals and applications of Group theory and Phase Rule	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Electro Chemistry I

(10 Hours)

Conduction in metals and in electrolytic solutions- Specific, molar and equivalent conductance- Measurement of conductivity in electrolytic solutions-Variation of equivalent and specific conductance with dilution- Faraday's law of electrolysis- Arrhenius theory of electrolytic dissociation- Ostwald's dilution law and limitations -Kohlrausch's law – statement and applications- Debye-Huckel-Onsager theory of strong electrolytes (elementary treatment only)- Debye – Falkenhagen effect and Wien effect- Transport number: definition, determination

by moving boundary method and Hittorf's method.

Unit II: Electro Chemistry II

(11 Hours)

Electrochemical cells: Electrolytic and Galvanic cells- Kinds of electrodes- Single electrode potential- determination and significance of electrode potential - SHE- sign convention-EMF-measurement of cell emf and its applications - Weston–Cadmium cell - Nernst equation- Electrochemical series and its applications-activity and activity co-efficient- Determination of ΔG , ΔH and ΔS of a cell reaction- Concentration cells with and without transference- Liquid junction potential-Electrodes for measurement of pH- Redox potentials – redox indicators – uses with particular reference to diphenylamine.

Unit III: Electro Chemistry III

(10 Hours)

Hydrolysis of salts – degree of hydrolysis- Potentiometric titrations- Conductometric titrations- Batteries: Types-Dry cell-Alkaline battery- Storage cells - Ni-Cd battery - lead storage cell. Fuel cells- definition and importance- Hydrogen – Oxygen fuel cell and its application in manned space flights. Corrosion: Definition, effects and causes- types: Galvanic, pitting, intergranular and waterline corrosion- methods of prevention of corrosion: cathodic protection and galvanization.

Unit IV: Electroanalytical and Thermoanalytical techniques

(11 Hours)

Electro analytical techniques Introduction and types- Electrodeposition of metals: overvoltage and electroplating (theory alone)- Polarography– theoretical principle-Ilkovic equation (derivation not necessary)- Polarographic maxima-Half wave potential-Instrumentation-DME- Polarographic technique- Applications in qualitative and quantitative applications.

Thermo analytical techniques- Introduction and types – types TGA principle Instrumentation TGA analysis of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ - Derivative thermo gravimetric analysis- Differential thermal analysis principle DTA of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ - factors affecting TGA & DTA- factors affecting thermogram.

Unit V: Group theory and Phase Rule

(10 Hours)

Group theory: Symmetry elements and symmetry operations- products of symmetry operations, classes, subgroups – group multiplication table and properties of a group- Point groups – C_{2v} , C_{3v} , C_{2h} , D_{4h} and D_{6h}

Phase rule– statement and definition of terms- derivation of Gibbs phase rule- application of one component system: water- two component systems of solid \leftrightarrow liquid equilibria- simple eutectic: Pb-Ag system- Compound formation with congruent melting point: Zn-Mg system- Incongruent melting point: Na-K system- thermal analysis and cooling curves.

Note: Only 10% of question paper can carry problems.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma and S. P. Madhan	Vishal publications, 47 th ed., 2015
	Elements of Analytical Chemistry	R. Gopalan, P. S. Subramanian and K. Rengarajan	S. Chand and sons publications, 3 rd ed., 2016.
I-V	Text book of Physical Chemistry	L. K. Sharma, and K.K. .Sharma	Vikash publications, 5 th ed., 2014.
IV	Instrumental approach to chemical analysis	A. K Srivastava, and P.C. Jain,	S. Chand and Sons publications, 4 th ed., 2013
V	Group theory in Chemistry	M. S. Gopinathan and V. Ramakrishnan	Vishal publications, 2 nd ed., 2013.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Atkins' Physical Chemistry	Peter Atkins, and Julio De Paula,	Oxford university press, 9 th ed., 2013.
2.	Chemical applications of Group theory	F. Albert Cotton	Wiley India publications, 3 rd ed., 2016.
3.	An Introduction to Electrochemistry	Samuel Glasstone	Affiliated East- West press Pvt. Ltd., 2016

E-Resources : (Web resources & E-books)

- <https://www.khanacademy.org>
- http://www.engr.uconn.edu/~jmfent/CHEG320_electrochemistry%20lectures.pdf
- https://www2.chemistry.msu.edu/courses/cem142posey/Slides/18_LectureWeb.pdf
- <https://nptel.ac.in/courses/122101001/>
- <http://www.freebookcentre.net/>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	H	H	L	M	M	M	A
CO 2	H	H	L	M	M	M	A
CO 3	H	H	L	M	M	M	A
CO 4	H	M	L	M	M	M	A
CO5	H	M	L	M	M	M	A

Content delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Flip class room
- Seminar
- Visual aids

- Charts and posters
- Models
- Demonstration
- Open source
- Problem solving
- Peer teaching

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Group Discussion Modeling a Concept	Course Exit Survey

Internal Assessment components:

Components	CIA	Group Discussion	Modeling a Concept	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Group Discussion (4)	Modeling a Concept (4)
R	30%	30%	Presentation: 50% (2 Marks) Content : 25% (1 Mark) Interaction/overall Effort :25% (1 Mark)	
U	40%	40%		
A	30%	30%		

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10) MCQ										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory; P-Problems									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20					
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b			
I	✓	✓									T	T					T	T							
II			✓	✓								T	T					T	T	P					
III					✓	✓							T	T	P				T	T					
IV							✓	✓						T	T						T	T			
V									✓	✓						T	T					T	T		

Course Designed by	Dr. J. Bhuvaneshwari
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Course Reviewed by	Mrs. S. Umadevi	
Head of the Department	Mrs. M. Malarvizhi	

**B.Sc Chemistry
Semester VI**

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core XI Spectroscopy	Course Code: 617C11
Semester: VI	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T: Tutorial)

Course Objectives:

- To acquire knowledge on interactions of electromagnetic radiation with matter and their applications in spectroscopy
- To understand the principle and instrumentation of rotational, IR, Raman, NMR, ESR and mass spectrometric techniques
- To learn the factors affecting the position of signals in the spectrum
- To appreciate the applications of rotational, IR, Raman, NMR, ESR and mass spectrometric techniques
- To analyze and interpret spectroscopic data collected by the methods discussed in the course.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Recognize the phenomenon of the interaction of light with matter in terms of the relationship with the molecular structure	U
CO2	Describe the principle and instrumentation of rotational, IR, Raman, UV, NMR, ESR and mass spectrometric techniques	U
CO3	Summarize the applications of rotational, IR, UV, NMR and mass spectrometric techniques	U
CO4	Select suitable molecular spectroscopy methods and solve the given scientific problem	A
CO5	Relate the factors affecting positions of absorption signals, solve and interpret basic spectroscopic data to predict and extract the structures at a preliminary level	A

R-Remembrance U –Understanding A-Apply

Syllabus:

<p>Unit I: Electromagnetic Spectrum (9 Hours)</p> <p>Atomic and molecular Spectroscopy – Absorption and emission spectra- electromagnetic radiation, wavelength, wave number, frequency and energy- regions of electromagnetic spectrum and absorption of radiation- types of molecular energies – Born-oppenheimer approximation.</p> <p>Microwave spectroscopy: Principle and theory- diatomic molecule as a rigid rotor-</p>
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selection rule- instrumentation- applications of rotational spectroscopy- structures of Xenon oxy fluoride, ammonia and Benzotrile and abundance of isotopes.

Unit II: IR Spectroscopy and Raman Spectroscopy (11Hours)

Theory- molecular vibrations- vibrational frequency- force constant- vibrational energy- zeropoint energy- degrees of freedom for linear and non-linear molecules- selection rule- complexity of the spectrum- reasons- factors influencing vibrational frequencies- coupled vibration, fermi resonance and electronic effects- instrumentation- finger print region- overtones, combination and difference bands- applications of IR spectroscopy- qualitative analysis of functional groups- distinction between H-bonding, keto-enol tautomerism and geometrical isomerism-characteristic IR absorption frequencies of important functional groups- vibrational spectra of H₂O and CO₂.

Raman spectroscopy- Rayleigh and Raman scattering- stokes and anti-stokes lines- differences between Raman and IR spectroscopy - Mutual exclusion principle -CO₂

Unit III: Electronic Spectroscopy (10 Hours)

Theory of UV spectra- electronic transitions- chromophore concept: chromophore, auxochrome, bathochromic, hyperchromic and hypsochromic effect- - instrumentation -Woodwards Fischer rules- calculation of absorption maxima in dienes only - Franck- Condon principle- applications: detection of functional groups and geometrical isomers.

Atomic absorption spectrometry –Flame photometry – Principle, instrumentation and applications.

Unit IV: NMR Spectroscopy (11Hours)

Theory- number of signals- equivalent and non-equivalent protons – instrumentation- chemical shift- TMS-factors influencing chemical shift- sheiding and deshielding effects: anisotropy with reference to ethylene, acetylene and benzene- rules for splitting of signals- splitting of signals with reference to 1,1,2- tribromoethane, acetaldehyde, benzaldehyde and ethanol - causes of proton signals- coupling constant(elementary idea only).

Unit V: ESR Spectroscopy and Mass Spectrometry (11 Hours)

ESR spectroscopy- theory- presentation of ESR spectrum- instrumentation-g factor- hyperfine splitting- ESR spectrum of hydrogen atom and methyl free radical.

Mass Spectrometry - theory and basic principles- double focusing mass spectrometer - types of ions produced in mass spectrometer- molecular ion peak, base peak, dissociation process, rearrangement, multiple charged ions, negative ions and metastable ions -fragmentation: simple cleavage, retro Diel's Alder and Mc-Lafferty Rearrangement- important features of mass spectrum of saturated hydrocarbons and alcohols-mass spectrum and fragmentation pattern of methane and dodecane.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Spectroscopy	Gurdeep R.	Chatwal, Himalaya publications, 5 th ed., 2015

I-V	Elementary organic absorption spectroscopy	Y. R. Sharma	S.Chand and Sons publications, 5 th ed., 2016.
I-V	Instrumental approach to chemical analysis	A. K. Srivastava and P. C. Jain	S.Chand and Sons publications, 4 th ed., 2013
I-V	Organic spectroscopy Principles & applications	Jag Mohan	Narosa Publications, 2 nd ed., 2014

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Spectroscopy of organic compounds	P. S. Kalsi	New age international Pvt. Ltd. publications, 6 th ed., 2011
2.	Spectroscopy	B. K. Sharma	Goel Publications, 23 th ed., 2013
3.	Molecular structure and spectroscopy	G. Aruldas	Goel publishing house, 2 nd ed., 2016

E-Resources: (Web resources & E-books)

- <https://chemistry.com.pk/books/organic-spectroscopy-by-l-d-s-yadav/>
- <https://chemistry.com.pk/books/pavia-introduction-to-spectroscopy/>
- <https://chemistry.com.pk/books/skoog-principles-of-instrumental-analysis/>
- <http://chemistry.com.pk/books/analytical-chemistry-by-gary-d-christian/>
- <https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay/infrared-spectroscopy-theory/v/introduction-to-infrared-spectroscopy>
- <https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay/uv-vis-spectroscopy/v/uv-vis-spectroscopy>
- <https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay/proton-nmr/v/introduction-to-proton-nmr>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Cognitive levels
CO 1	H	M	-	-	M	M	U
CO 2	H	M	-	-	M	M	U
CO 3	H	M	-	-	M	M	U
CO 4	H	M	-	-	M	M	A
CO 5	H	M	-	-	M	M	A

Content delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Instrumentation centre visit
- Open source
- Peer teaching
- Problem solving

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Gallery walk Online test	Course Exit Survey

Internal Assessment components:

Components	CIA	Gallery walk	Online test	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Gallery walk (4)	Online test (4)
R	30%	30%	Content - 25% (1 Mark) Presentation - 50% (2 Marks) Interaction/Overall effort-25% (1 Mark)	R- 30%
U	40%	40%		U-40%
A	30%	30%		A-30%

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory; P-Problems														
	MCQ										11		12		13		14		15		16		17		18		19		20	
	1	2	3	4	5	6	7	8	9	10	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b		
I	✓	✓								T	T							T	T											
II			✓	✓								T	T							T	T & P									
III					✓	✓								T	T					T	T & P									
IV							✓	✓								T	T							T	T					
V								✓	✓									T	T							T	T			

Course Designed by	Mrs. M. Malarvizhi
Course Reviewed by	Mrs. S. Umadevi
Head of the Department	Mrs. M. Malarvizhi

B. Sc Chemistry Semester –VI

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Elective III Industrial Chemistry	Course Code: 617CE4
Semester: VI	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To acquire knowledge about glass, ceramics, refractories and cement.
- To know the chemistry behind explosives, propellants and toxic chemical weapons.
- To obtain knowledge on Oils, fats and cleansing agents.
- To understand the principles and industrial applications of fermentation.
- To learn and understand about Adhesives and lubricants.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Summarize preparation and uses of Explosives, propellants and toxic chemical weapons.	U
CO2	Generalise adhesive and lubricants.	A
CO3	Implement Rubber and Leather technology.	A
CO4	Design Paper Technology.	A
CO5	Develop Textile Technology.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Explosives, propellants and toxic chemical weapons (10 Hours)

Explosives: Introduction and classification- characteristics of explosives- preparation and uses of TNT, nitrocellulose and nitroglycerin- gunpowder and RDX-precautions during storage of explosives-propellants-characteristics and classification-toxic chemicals: definition and requisites- study of mustard gas, phosgene, chloropicrin, teargas and nerve gas- brief study on smoke screens and pyrotechnics.

Unit II – Adhesives and lubricants (11 Hours)

Adhesives: Introduction- classification- adhesive action- development of adhesive

strength- chemical factors influencing adhesive action- bonding processes by adhesives – advantages and limitations. Lubricants: Introduction-functions- classification- substances used as lubricants- synthetic lubricants- lubricating greases- solid lubricants: Graphite, molybdenum disulphide-properties-viscosity, flash point, fire point, aniline point, neutralization number, carbon residue test-selection of lubricants.

Unit III- Rubber and Leather technology (10 Hours)

Rubber - Introduction - types of rubbers - characteristics of rubbers - latex - processing latex - mastication - compounding of rubber - drawbacks of natural rubber - rubber fabrication-vulcanizations of rubber - types of vulcanization - properties of vulcanized rubber- synthetic rubbers: preparation and applications of SBR, butyl rubber, nitrile rubber, neoprene and silicone rubber.

Leather technology:Introduction- animal skins- manufacture of leather- preparation of hides for tanning- vegetable tanning- chrome tanning- finishing- oil tanning.

Unit IV- Paper Technology (11 Hours)

Paper Technology:- Introduction- manufacture of pulp- various raw materials used for the preparation of pulp-preparation of sulphite Pulp, soda Pulp, rag pulp- various processes: beating refining, filling sizing and colouring- manufacture of paper, calendaring, uses-paper products: filter paper,card board and plywood - economical problems of Indian pulp and Paper industry- Paints: definition, requisites and constituents of paints-pigments: white lead, titanium dioxide, and red lead-varnishes-characteristics and manufacture.

Unit V- Textile Technology (10 Hours)

Textile fibres- introduction- plant fibres– structure and composition of cotton and linen – common tests for linen and cotton in cloth– animal fibres– properties, structure and composition of wool and silk- mineral fibre: introduction, properties and uses of asbestos, glass fibres and metallic fibres-yarn formation: blending, opening, cleaning, carding, doubling, combing, drawing, roving and spinning-yarn to fabric: weaving , shedding , picking and beating up textile process: scouring- desizing- singeing- bleaching- dyeing.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I- III	Industrial chemistry	B.K. Sharma, and Goel publications	Goel publications, 12 th ed., 2016.
I- III	Industrial Chemistry	M. G. Arora and M. Singh	Anmol Publications, Volume I and II, 1 st ed.,1994.
IV and V	Engineering Chemistry	N.Krishnamurthy, P.Vallinayagam and D.Madhavan	PHI Learning private limited,2 nd edition, 2009

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Reigel's Hand book of	James A. Kent	CBS publications, 9 th ed.,

	Industrial Chemistry		1997.
2.	Engineering Chemistry	Jain and Jain	Dhanpat Rai Publication, Reprint 2010.

E-Resources: (Web resources & E-books)

- <https://chemistry.com.pk/books/organic-spectroscopy-by-l-d-s-yadav/>
- <https://chemistry.com.pk/books/pavia-introduction-to-spectroscopy/>
- <https://chemistry.com.pk/books/skoog-principles-of-instrumental-analysis/>
- <http://chemistry.com.pk/books/analytical-chemistry-by-gary-d-christian/>
- <https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay/infrared-spectroscopy-theory/v/introduction-to-infrared-spectroscopy>
- <https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay/uv-vis-spectroscopy/v/uv-vis-spectroscopy>
- <https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay/proton-nmr/v/introduction-to-proton-nmr>
- <https://www.youtube.com/watch?v=EnB7aw7IGxg>
- <https://www.youtube.com/watch?v=o8zELwp358A>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's Taxonomy level
CO 1	M	L	-	L	M	M	U
CO 2	H	L	-	M	M	M	A
CO 3	H	M	-	M	M	M	A
CO 4	H	M	-	M	M	M	A
CO 5	H	M	-	M	M	M	A

Content Delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Flip class room
- Industrial visits
- Open source
- Gallery walk
- Video
- Charts and posters

Course Evaluation Methods:

Direct Methods	Indirect Methods
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Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Group Discussion	Course Exit Survey
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Internal Assessment components:

Components	CIA	Assignment	Group Discussion	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Group Discussion (4)
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50% (2 Marks) Presentation :25% (1 Mark)	Presentation: 50% (2 Marks) Content : 25% (1 Mark) Interaction/overall Effort :25% (1 Mark)
U	40%	40%		
A	30%	30%		

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10) MCQ										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory; P-Problems											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20							
											a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	
I	✓	✓									T	T					T	T									
II			✓	✓								T	T					T	T								
III					✓	✓							T	T					T	T							
IV							✓	✓							T	T							T	T			
V								✓	✓							T	T								T	T	

Course Designed by	Mrs. R.Chitradevi	
Course Reviewed by	Mrs. S.Umadevi	

Head of the Department	Mrs.M.Malarvizhi	
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B. Sc Chemistry
Semester –VI

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Elective III Applied Chemistry	Course Code: 617CE5
Semester: VI	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To acquire basic knowledge in non-renewable energy
- To learn and understand the utilization of renewable energy.
- To get knowledge in rubber and Leather technology.
- To obtain knowledge in paper technology.
- To attain information in Textile Technology.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Execute the utilization of non renewable energy sources .	A
CO2	Design instruments for renewable energy sources	A
CO3	Demonstrate the manufacture of Glass and cement.	U
CO4	Formulate the principle and usage of oils and fats in different products.	A
CO5	Execute Fermentation process in various industries.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I Energy Sources I	(11 Hours)
Introduction- renewable and non renewable energy sources- fuels: introduction, classification and characteristics of a good fuel- comparison between solid, liquid and gaseous fuels- calorific value-determination by bomb calorimeter	
Solid fuel:- Coal: introduction and different grades of coal- carbonization of coal- low and high temperature carbonizations- Liquid fuels:- Petroleum: origin and composition- refining and fractionation of petroleum- knocking: definition and its effects- antiknocking: definition and TEL, Fe(CO) ₅ - octane number and cetane number: definition and example- cracking: definition, catalytic and thermal cracking- Gaseous fuels:LPG:composition and uses- composition, manufacture and uses of natural gas, coal gas, oil gas, producer gas and water gas.	

Unit II - Energy Sources II**(11 Hours)**

Solar energy- thermal applications: solar water heater, solar cooker, solar drier- description of the apparatus and uses- Solar silicon cells-description and uses- Wind energy: description of wind mill its component and uses (elementary idea only)- Biofuels:-Gobar gas- construction of the plant, operation and uses- Geothermal energy: origin and its utilization of geothermal energy- Environmental hazards from the use of geothermal energy- elementary aspects of biomass energy and tidal energy.

Unit III: Glass, ceramics, refractories and cement**(11 Hours)**

Glass: Introduction –chemical properties – manufacture of glass- types of glass:soft glass, hard glass, pyrex glass, safety glass and optical glass- composition and applications. Ceramics:introduction- general properties- raw materials for ceramics- pottery products of ceramics:porous and non-porous wares, earthenware and stoneware. Refractories: Introduction- classification- properties- manufacture –fireclay, High alumina and silica refractories:properties- manufacture. Cement: introduction and composition of portland cement- manufacture and setting of cement.

Unit IV: Oils, fats and cleansing agents**(10 Hours)**

Fats and oils: Introduction, classification and properties- vegetable oil: manufacture of soya bean oil by solvent extraction only-refining of crude oil-hydrogenation of oil-analysis of oils and fats: definition, significance and estimation of acid value, saponification value, RM value and Iodine value. Waxes: classification and properties –synthetic oils, fats and waxes.

Cleansing agents: soap- definition – raw materials- manufacture by continuous hot process- varieties of soap and their uses only (manufacture not necessary)- cleansing action of soap- detergent: introduction –principal groups of synthetic detergents-classification of surface active agents: anionic, cationic, zwitter ionic and non-ionic detergents bio-degradability of surfactants-detergents containing enzymes-distinction between soaps and detergents-manufacture of shampoos.

Unit V: Fermentation**(9 Hours)**

Fermentation: Introduction– conditions favourable for fermentations – fermentation processes- enzymes: characteristics of enzymes – manufacture of starch by fermentation process –manufacture of beer, wine and vinegar- importance of power alcohol as a fuel-distillery effluent for agricultural production-manufacture of ethanol from molasses and uses – manufacture of sucrose from cane sugar and beetroot- estimation of sugar: sulphitation and carbonation process.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-III	Industrial chemistry	B.K. Sharma	Goel publications, 12 th ed., 2016.
I-III	Industrial Chemistry	M. G. Arora and M. Singh	Anmol Publications, Volume I and II, 1 st ed.,1994.

IV	Handbook of pulp and paper technology	Kenneth W. Britl	CBS publications, 1 st ed., 1984.
V	Textile fibre to fabric	Bernard P. Corbman	McGraw Hill book publications, 6 th ed., 1984,.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Reigel's Hand book of Industrial Chemistry	James A. Kent	CBS publications, 9 th ed., 1997.
2.	Engineering Chemistry	Jain and Jain	Dhanpat Rai Publication, Reprint 2010.

E-Resources: (Web resources & E-books)

- https://www.acehsc.net/wpcontent/uploads/Industrial_Chemistry_by_Rohan_Barar.pdf
- <https://nptel.ac.in/courses/112104225/22>
- https://nptel.ac.in/courses/113104058/mme_pdf/Lecture1.pdf
- <https://nptel.ac.in/courses/103107082/34>
- <https://nptel.ac.in/courses/103107082/7>
- <https://nptel.ac.in/courses/116102005/>
- https://www.slideshare.net/patelpranav93/e-paper-40017944?qid=d9423103-37d9-48eb-ad90-6a858c25b7f0&v=&b=&from_search=1

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Bloom's Taxonomy level
CO 1	H	L	-	M	M	M	A
CO 2	H	L	-	M	M	M	A
CO 3	H	M	-	M	-	M	U
CO 4	H	M	-	M	-	M	A
CO5	H	M	-	M	-	M	A

Content Delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Flip class room
- Industrial visits
- Open source
- Charts and posters

Course Evaluation Methods:

Direct Methods	Indirect Methods
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Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Group Discussion	Course Exit Survey
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Internal Assessment components:

Components	CIA	Assignment	Group Discussion	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions	(10 X 1= 10 marks)
Section B	Either or Type - 5 Questions	(5 X 4= 20 marks)
Section C	Either or Type - 5 Questions	(5 X 9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (75)	CIA II (75)	Assignment (4)	Group Discussion (4)
R	30%	30%	Overall Structure: 25% (1 Mark)	Presentation: 50% (2 Marks)
U	40%	40%	Content : 50% (2 Marks)	Content : 25% (1 Mark)
A	30%	30%	Presentation :25% (1 Mark)	Interaction/overall Effort :25% (1 Mark)

Blue Print for End Semester Examination

Unit	Section A (10 x 1 = 10) MCQ										Section B (5 x 4 = 20)					Section C (5 x 9 = 45) T-Theory								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b		
I	✓	✓									T	T					T	T						
II			✓	✓								T	T					T	T					
III					✓	✓							T	T					T	T				
IV							✓	✓							T	T					T	T		
V									✓	✓						T	T						T	T

Course Designed by	Mrs. R.Chitradevi
Course Reviewed by	Mrs. M.Malarvizhi
Head of the Department	Mrs.M.Malarvizhi

B. Sc Chemistry
Semesters – V and VI

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core Practical III Gravimetric Analysis and Physical Chemistry Experiments	Course Code: 617CP3
Semesters: V and VI	No. of Credits: 4
No. of hours : 120	P:R 104:16
CIA Max. Marks: 40	ESE Max. Marks:60

(C: Contact hours, R: Record and Observation)

Course Objectives:

- To acquire the quantitative skills in gravimetric analysis.
- To learn the fundamentals of conductometric and potentiometric titrations.
- To understand the method of determination of molecular weight, CST, TT and rate constant.
- To improve their skills in quantitative analysis by carrying out various physical chemistry experiments using sophisticated instruments.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Develop some understanding of the professional and safety responsibilities residing in working with chemical systems and to organise the glassware and other apparatus to conduct experiments in Gravimetry and Physical Chemistry.	U
CO2	Review and emphasize skills in stoichiometric calculations	U
CO3	Discuss and execute the steps involved in the gravimetric analysis of a given sample and to Interpret data from the physical chemistry experiments, including the construction of appropriate tables, and graphs	A

R-Remembrance U –Understanding A-Apply

Syllabus:

I. Gravimetric analysis

1. Estimation of barium as barium sulphate
2. Estimation of barium as barium chromate.
3. Estimation of lead as lead chromate.
4. Estimation of calcium as calcium oxalate.
5. Estimation of calcium as calcium carbonate.
6. Estimation of nickel as nickel dimethyl glyoximate.
7. Estimation of magnesium as magnesium oxinate (demonstration).

II. Physical chemistry

1. Phase diagram- simple eutectic system.
2. Determination of critical solution temperature of phenol - water system.
3. Determination of concentration of electrolyte – NaCl/ Succinic acid from the miscibility temperatures of phenol-water system .
4. Estimation of Fe^{3+} in water spectro photometrically.
5. Determination of transition temperature of a salt hydrate.
6. Determination of K_f and molecular weight by Rast method.
7. Determination of rate constant of acid catalyzed hydrolysis of an ester.
8. Determination of cell constant, specific conductivity and equivalent conductivity of strong electrolyte
9. Determination of dissociation constant of a weak acid (acetic acid)
10. Conductometry – Acid-Base titration HCl Vs NaOH
11. Estimation of Fe^{2+} by potentiometric method using redox titration.
12. Study of Freundlich adsorption isotherm using colorimeter.(demonstration).
13. Potentiometric study Strong acid vs strong base.
14. Estimation of sodium using flame photometer.
15. Determination of Heat of solution of oxalic acid in water.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Basic Principles of Practical Chemistry	V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu	S. Chand and Sons publications, 2 nd ed., 2016.
2.	Advanced Practical Chemistry	Raghupati Mukhopadhyay Pratul Chatterjee	Books and Allied publications, 3 rd ed., 2007.
3.	Vogel's Text Book of Practical Organic Chemistry	B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell	Pearson Edn., Ltd., 5 th ed., 2009.
4.	College Practical Chemistry	V.K. Ahluwalia, Sunita Dhingra, Adarsh Gulati	Universities press

E-Resources : (Web resources & E-books)

- www.calstatela.edu/.../201/lecture4-gravimetric.pdf
- www.calstatela.edu/.../201-lec/chapt27-lecture-c201.pdf
- www.khanacademy.org/science/chemistry/chemical...
- www.youtube.com/watch?v=gR1ZUIV3n5E

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	H	M	-	H	M	M	U
CO 2	H	M	-	H	M	M	U
CO 3	H	M	L	H	M	M	A

Content Delivery Methods (Any two):

- Hands-on-training
- Demonstration

- Peer teaching
- Practical session
- Industrial/Instrumentation visits

Course Evaluation Methods:

Direct Methods	Indirect Methods
Lab Performance Record Model Exam	Course Exit Survey

Internal Assessment components:

Components	Lab Performance	Record	Model Exam	Attendance	Total
Marks	16	12	10	2	40

Evaluation will be made based on Weightage % given

Bloom's Category	Lab performance	Record	Model Examination
A	Punctuality : 25% (4 Marks) Safety and Hygiene : 25% (4 Marks) Experimental Skill: 25% (4 Marks) Observation Note : 25% (4 Marks)	Punctuality : 25% (3 Marks) Neatness : 25% (3 Marks) Calculations:25% (3 Marks) Accuracy : 25% (3Marks)	Model Examination Marks converted to 10 marks

Question Paper Pattern

Section	Experiments	Marks
A	Gravimetry	40 % (24 Marks)
B	Physical Experiments	50 % (30 Marks)
C	Viva Voce (Questions from CO1, CO2 and CO3)	10 % (06 Marks)

End Semester Practical Examination Assessment components:

Components	Gravimetry	Physical Experiment		Viva-voce	Total
		Manipulation	Execution		
Marks	24	10	20	6 (Questions from CO1, CO2 & CO3)	60

Scheme of evaluation for Gravimetric analysis :Experiment (Result) : 24 marks**Distribution of marks for the result:**

Error up to 2%	: 24marks
Error between 1-2%	: 20 marks
Error between 2-3%	: 15 marks
Error between 3-4%	: 12 marks
Error above 4%	: 10 marks

Scheme of valuation for Physical experiments: Experiment: 30 marks**Distribution of marks for the Experiment:**

For carrying out the experiment (manipulation)	: 10 marks
Value	: 20 marks
Total	: 30 marks

Course Designed by	Dr.M.Indrani	
Course Reviewed by	Mrs. M.Malarvizhi	
Head of the Department	Mrs.M.Malarvizhi	

B. Sc Chemistry

Semesters – V and VI

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Core Practical IV Applied Chemistry Practical	Course Code: 617CP4
Semesters – V and VI	No. of Credits: 2
No. of hours : 60	C:P:R 4:56:10
CIA Max. Marks: 25	ESE Max. Marks:50

(C: Contact Hours, P: Practical, R:Record and Observation Work)

Course Objectives:

- To enable the students to prepare organic compounds
- To learn the colorimetric techniques for estimation of cations
- To know the method of determining the melting and boiling point of organic chemicals

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the apparatus handling such as melting point, boiling point and Soxhlet extraction.	U
CO2	Develop basic skills for the determination of physical parameters, estimations, multi-step synthesis of organic compounds and water analysis.	A
CO3	Apply basic techniques used in chemistry laboratory for preparation, purification and identification.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

<ol style="list-style-type: none"> 1. Determination of melting and boiling point of organic substances 2. Colorimetric experiments using Nessler's tubes: <ol style="list-style-type: none"> a. Estimation of Fe^{3+} with ammonium thiocyanate b. Estimation of nickel as nickel dimethyl glyoximate c. Estimation of Mn^{2+} in KMnO_4 using potassium iodate 3. Preparation of organic compounds <ol style="list-style-type: none"> a. Acetanilide from aniline (acetylation) b. p- Bromo acetanilide from Acetanilide(Bromination) c. Phenylbenzoate from phenol (Benzoylation) d. Salicylic acid from ethylsalicylate (Hydrolysis)

- e. Nitrosalicylic acid from Salicylic acid (Nitration)
 f. Benzoic acid from benzaldehyde (Oxidation)
 g. Preparation of dyes – Methyl orange and Phenyl azo – 2 - naphthal.
5. Water Quality Parameter Analysis
 Alkalinity, Hardness, Chloride, Dissolved Oxygen, Estimation of TDS, TSS, TS and pH of the given water samples
6. Determination of water of crystallization of barium chloride dihydrate.
7. Group experiments:
 a. Soxhlet extraction
 b. Determination of saponification value of oil

Books for Reference:

Unit	Name of the Book	Authors	Publishers with Edition
1.	Basic Principles of Practical Chemistry	V. Venkateswaran, R. Veeraswamy, and A. R. Kulandaivelu	S. Chand and Sons publications, 2016.
2.	Advanced Practical Chemistry	Raghupati Mukhopadhyay, and Pratul Chatterjee	Books and Allied publications, 3 rd ed., 2007.
3.	Vogel's Text Book of Practical Organic Chemistry	B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell	Pearson Edn., Ltd., 5 th ed., 2009.

E-Resources : (Web resources & E-books)

- <http://vlab.amrita.edu/>
- <http://vlab.amrita.edu/?sub=2&brch=193&sim=1548&cnt=2>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	H	H	M	M	M	M	U
CO 2	H	H	M	M	M	M	A
CO 3	H	H	M	M	M	M	A

Content delivery Methods (Minimum Two):

- Lecture Method
- Demonstration Class
- Problem Solving
- Virtual Laboratory

Course Evaluation Methods:

Direct Methods	Indirect Methods
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Lab Performance Record Model Practical Examination	Course Exit Survey
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Internal Assessment components:

Components	Lab Performance	Record	Model Practical Examination	Attendance	Total
Marks	8	8	7	2	25

Question Paper Pattern

Section	Experiments	Marks
A	Estimation	30 % (15 Marks)
B	Preparation	40 % (20 Marks)
C	Melting point / Boiling point	20 % (10 Marks)
D	Viva Voce (Questions from CO1, CO2 and CO3)	10 % (05 Marks)

Evaluation will be made based on Weightage % given

Bloom's Category	Lab performance (8)	Record (8)	Model Examination
A	Punctuality : 25% (2 Marks) Safety and Hygiene : 25% (2 Marks) Experimental Skill : 25% (2 Marks) Observation Note : 25% (2 Marks)	Punctuality : 25% (2 Marks) Neatness : 25% (2 Marks) Calculations: 25% (2 Marks) Accuracy : 25% (2 Marks)	Model Examination Marks converted to 7 marks

ESE Assessment components:

M.pt/ B.pt (10 Marks)	
Within $\pm 2^0$	= 10 marks
Between 2^0 to 3^0	= 08 marks
Above 3^0	= 05 marks
Preparation (20 marks)	
Recrystallisation & Quality	= 05 marks
Quantity	= 15 marks
Estimation (15 marks)	
Error up to 10%	= 15 marks
Error between 10 to 15%	= 12 marks
Error between 15 to 20%	= 09 marks
Above 20%	= 05 marks

Course Designed by	Dr.J.Bhuvaneswari	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry Semester – VI

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part IV Skill Enhancement Course IV Nanoscience	Course Code: 617CS4
Semester: VI	No. of Credits: 3
No. of hours : 45	C:P:T 33:6:6
CIA Max. Marks: 75	ESE Max. Marks: -

(C:Contact hours, T:Tutorial, P:Practical)

Course Objectives:

- To know the basics of nanoscience and nanotechnology.
- To learn characterization techniques of nanomaterials.
- To understand the applications of nanomaterials.
- To acquire skill in synthesizing nanoparticles.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Know the history and future aspects of Nanoscience and nanotechnology.	R
CO2	Classify nanostructured materials.	A
CO3	Apply various methods for synthesis of nanomaterials.	A
CO4	Recognize some common characterization techniques of nanomaterials and apply them in various interdisciplinary fields.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Fundamentals and overview of Nanoscience:	(6 Hours)
Nano revolution of the XX century- Properties of nanoscale materials. Definitions, scaling and importance of nano materials-Current status and future of nanomaterials.	

Unit II: Different classes of nanomaterials:	(7 hours)
Metal and Semiconductor Nanomaterials, Types of nanoparticles – preparation, properties and uses of gold, silicon, silver, zinc oxide, iron oxide and titania nanoparticles (common growth methods). Quantum Dots, Wells and Wires, Graphene, Molecule to bulk transitions Bucky balls and Carbon Nanotubes.	

Unit III: Synthesis of nanomaterials: (7 hours)

Physical methods: Bottom up-Ball Milling, Melt mixing, Physical vapour deposition, Laser pyrolysis, Sputter deposition. (Preliminary ideas only)

Chemical methods: Hydrothermal combustion, bath deposition with capping techniques and top down, Chemical vapour deposition, Synthesis of metal & semiconductor nanoparticles by colloidal route, Microemulsions, Sol-gel method, Wet chemical method. (Preliminary ideas only)

Unit IV: Nano Materials and their Characterization: (7 hours)

Electron microscopes – scanning electron microscopes (SEM) – transmission electron microscopes (TEM) – scanning probe microscopy – atomic force microscopy (AFM) – scanning tunneling electron microscope (STEM) – TEM and EDAX analysis, X-ray Diffraction. (Basic principles only)

Unit V: Nanoapplications: (6 hours)

Solar energy conversion- Chemical semiconductor solar cells – Dye sensitized solar cells – Nano quantum dot solar cells – and catalysis, Nanosensor, Nanomedicine, Nanomaterials in water purification and food science.

Practicals : Synthesis of Nanomaterials: (6 hours)

1. Chemical Synthesis of Copper nanoparticles
2. Chemical Synthesis of iron oxide nanoparticles
3. Chemical Synthesis of CdS Nanoparticles
4. Eco friendly synthesis of metal oxide nanoparticles.
5. Bandgap calculation of nanoparticles using UV-Visible spectroscopy.
6. Chemical Synthesis of Silver nanoparticles (demonstration)
7. Synthesis of ZnO Nanoparticles using Sol-gel methods (demonstration)
8. Synthesis of nanoparticles using Ball milling technique (demonstration)

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I/II	Nanotechnology principles and Practices	Sulabha K Kulkarni	Second Edition Capital publishing company New Delhi Reprint 2011.
III/ IV/V	Nano: The Essentials	T. Pradeep	Tata Mc-Graw Hill New Delhi Edition 2007.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Nanoscience and Nanotechnology	T. Pradeep	Tata Mc-Graw Hill New Delhi Edition 2012
2.	Bio-Nanotechnology Concept & Application	Madhuri Sharon, Maheshwar Sharon, Sunil Pandey, Goldie Oza	Ane Books Pvt Ltd, Edition 2012

E-Resources : (Web resources & E-books)

1. <http://www.hailienene.com/resources/nano-technology.pdf>
2. http://elibrary.bsu.az/books_250/N_229.pdf
3. <https://www.aiha.org/aihce07/handouts/rt201krause.pdf>
4. http://elibrary.bsu.az/books_250/N_229.pdf
5. <https://bookboon.com/en/nano-technology-ebook>
6. https://www.youtube.com/watch?v=ebO38bbq0_4
7. <https://nptel.ac.in/courses/118104008/>
8. <https://nptel.ac.in/courses/118102003/3>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	Bloom's Taxonomy level
CO 1	H	M	-	M	M	M	R
CO 2	H	M	L	M	H	M	A
CO 3	H	H	-	M	H	M	A
CO 4	H	H	L	M	H	M	A

Content delivery Methods (Minimum Two):

- PPT and Video
- Demonstration
- Lecture Method
- Guest Lecture
- Group Assignments
- Hands-on-training
- Instrumentation visits
- Practical session

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Activity (Practicals)	Course Exit Survey

Internal Assessment components:

Components	CIA I	CIA II	(Activity: Practicals)		Total
			Lab performance	Record	
Marks	30	30	7	8	75

Question Paper Pattern

Section A	Either or Type - 5 Questions (5 × 4 = 20)
Section B	Either or Type - 5 Questions (5 × 8 = 40)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (60)	CIA II (60)	Activity (Practicals)	
			Lab performance (7)	Record (8)

R	30%	20%	Punctuality, Safety and Hygiene : 50% (3.5 Marks)	Punctuality : 25% (2 Marks) Neatness : 25% (2 Marks)
U	40%	40%		
A	30%	40%	Experimental skill and observation note: 50% (3.5 Marks)	Calculations: 25% (2 Marks) Accuracy : 25% (2 Marks)

Course Designed by	Dr. M. Indrani	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Chemistry

Semester – VI

(For the students admitted from the academic year 2017 – 2018 onwards)

Advanced Learner's Course II: Dairy Chemistry	Course Code: 617ALC
Semester: VI	No. of Credits: 4
No. of hours : -	C:T -
CIA Max. Marks: -	ESE Max. Marks: 100

Course Objectives:

- To impart knowledge in physico-chemical aspects of milk and milk products with special reference to their processing.
- To impart knowledge on different aspects of major milk products.
- To impart knowledge on fermented and other milk products.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Recognize the composition and factors affecting the composition of milk	R
CO2	Describe the processing of milk	U
CO3	Explain the major milk products and standardization of milk.	A
CO4	Summarize the methods of preparation of various milk products.	U
CO5	Implement the methods for production of fermented milk products	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I – Composition of Milk

Milk- Definition, general composition of milk- Constituents of milk- lipids, proteins, carbohydrates, vitamins and minerals- Physical properties of milk- colour, odour, acidity, specific gravity, viscosity and conductivity- Factors affecting the composition of milk- adulterants, preservatives and neutralizer- examples and their detection- Estimation of fat, acidity and total solids in milk.

Unit II – Processing of Milk

Micro biology of milk- destruction of micro organisms in milk- Physico- chemical changes taking place in milk due to processing- Boiling, pasteurization- types of pasteurization- bottle, batch and HTST(high temperature short time), Vacuum pasteurization- ultra high temperature pasteurization.

Unit III –Major Milk Products

Cream- definition- composition- Chemistry of creaming process- gravitational and centrifugal methods of separation of cream- estimation of fat in cream - Butter- definition, composition- theory of churning- desibutter- salted butter- estimation of acidity and moisture content in butter- Ghee- major constituents- common adulterants added to ghee and their detection- rancidity- definition- prevention- antioxidants and synergists- natural and synthetic.

Unit IV – Special Milk

Standardised milk- definition- merits- Reconstituted milk- definition- Flow diagram of manufacture- homogenized milk- flavoured milk- vitaminised- milk- toned milk- incitation milk- vegetable toned milk- humanized milk- condensed milk- definition, composition and nutritive value.

Unit V – Fermented and other Milk Products

Fermented milk products- fermentation of milk- definition, conditions- Cultured milk- definition of culture- examples, conditions- cultured cream- cultured butter milk- Bulgaxious milk- acidophilous milk- yoheer indigeneous products- Khoa - preparation of khoa , gulabjamun, and rassogalla- Ice-cream- definition- percentage composition- types ingredients- manufacture of ice-cream - Stabilizers- emulsifiers and their role - Milk powder- definition- need for making milk powder- drying process- types of drying- Dairy detergents- characteristics- classification- washing procedure- sterilization- hypochlorite solution.

Books for Study:

Unit	Name of the Book	Authors	Publishers with Edition
I/II	A text book of dairy Chemistry	Edgar. R. Ling	JV Publishing house 2 nd ed 2008.
I-III	Dairy Science	V.Rangarajan	Mangaldeep publications 1 st ed.2007.
II/III	Chemistry and testing of Dairy Products	Henry.V.Atherton JA. Newlander	CBS publishers, 4 th ed. 2000.
IV/V	Dairy microbiology	H.A.Modi	Aavishkar Publishers 1 st ed. 2009.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
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1.	Fundamentals of dairy chemistry	Webb Johnson and Alford	CBS Publisher, 2 nd edition, 2005.
2.	Dairy development in the New Millennium	Mohan Pd. Shrivastava, Jaishankar singh,	Deep and Deep publisher, 2008
3.	Dairy chemistry and animal nutrition	Dr.V.K. Chhazllani	Mangalam publisher, 2008
4.	Outlines of dairy technology	Sukumar De	Oxford publisher, 2007
5.	Milk and Milk products	Clarence Henry Eckles, Willes Barhes combs, Harold macy	Tata Mc Graw-Hill publisher, 4 th Edition, 2002

E-Resources : (Web resources & E-books)

1. <https://dairyprocessinghandbook.com/chapter/chemistry-milk>
2. <http://krishikosh.egranth.ac.in/bitstream/1/22109/1/BPT5303.pdf>
3. [http://www.khuisf.ac.ir/prof/images/Uploaded_files/DairyChemistryAndBiochemistry_muyac\[4303183\].PDF](http://www.khuisf.ac.ir/prof/images/Uploaded_files/DairyChemistryAndBiochemistry_muyac[4303183].PDF)
4. <http://www.doitwithdairy.com/>
5. <https://www.uoguelph.ca/foodscience/industry/dairy-education-ebook-series>

Blue Print for End Semester Examination

Bloom's Category	Section	Marks	Description	Total Marks
R	2 Questions	5 x 20 = 100	Questions covering all Units (Open choice 5 out of 8)	100
U	3 Questions			
A	3 Questions			

Question Paper Pattern (100 Marks) -Theory Paper for Advanced Learner's Course

Unit	Section A (5 x 20 = 100)							
	Open Choice							
	1	2	3	4	5	6	7	8
I	✓							
II		✓	✓					
III				✓				
IV					✓	✓		
V							✓	✓

Course Designed by	Mrs. R. Chitradevi	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Physics and Mathematics Semester – I/III

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Allied I/III Chemistry I	117AP1/317AM4
Semester: I/III	No. of Credits: 3
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:50

(C:Contact hours, T:Tutorial)

Course Objectives:

- To explain the reactivity of nucleophiles and electrophiles.
- To elicit the effect of electronic displacements on structure and reactivity of organic compounds.
- To interpret the structure of molecules in different ways (Fundamental aspects of atomic structure, bonding theories and hybridization).
- To describe the MO, VSEPR and VB theories and its significance in predicting the anomalous change in geometry of molecules due to different kinds of electronic interactions.
- To understand the acid/base theory, pH, buffer and concentration terms.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Enumerate the basic ideas related to organic reactions, types of organic reactions and organic solvents	A
CO2	Explain the preparation and properties of aromatic hydrocarbons	A
CO3	Predict the atomic structure and geometry of molecules based on hybridization and VSEPR theory	A
CO4	Summarize the basics of coordination chemistry, relate the theories and applications of coordination compounds.	A
CO5	Investigate the theories of acids, bases, concentration terms and relate the buffer action and pH in biological systems	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Organic Reactions	(10 Hours)
Organic reaction intermediates: Electrophiles and nucleophiles- Inductive effect – Electromeric effect- Comparison of Electromeric and Inductive effect- Mesomeric (resonance) effect- - Hyper conjugation and Steric effect (basic concepts only) - Types of reactions– Polar	

and Non-Polar solvents- water, hardness, Lime soda method of removing Hardness- preparation, properties and uses of Dichloro methane, Chloroform, Carbon tetrachloride, Fluorocarbons

Unit II: Aromatic Hydrocarbons (10 Hours)

Benzene- Electrophilic mono substitution reactions of benzene with mechanism – nitration and sulphonation reactions- polynuclear aromatic hydrocarbons: preparation, properties and synthetic uses of naphthalene, anthracene- structural elucidation of naphthalene.

Unit III: Atomic Structure and Chemical Bonding (11Hours)

Atomic structure: electronic configuration - Aufbau principle - Pauli's exclusion principle- Hund's rule.

Bonding: Ionic, Covalent, Hydrogen, van der Waals and Metallic bonding:- definition and examples - Molecular Orbital Theory: Basic concepts of MO theory- bonding and antibonding orbitals and bond order - application of MO theory to H₂, He₂, N₂, O₂- orbital overlap- s-s, s-p hybridization and VSEPR theory - BeCl₂, BF₃, CH₄, NH₃, H₂O, PCl₅, SF₆.

Unit IV: Co- ordination Chemistry (11 Hours)

Introduction of co-ordination chemistry- double salt, co-ordination compounds- definition and terminology: co-ordination complex, central ion, ligand- co-ordination number, co-ordination sphere, charge on complex ion- classification of ligands- Werner's theory - Nomenclature of co-ordination compounds- Sidgwick's effective atomic number- Pauling's valence bond theory- interpretation of properties of the following complexes: [Fe(CN)₆]⁴⁻, [CoF₆]³⁻, [Ni(CO)₄] - chelate formation– applications in analytical chemistry and living systems.

Unit V: Acid- Base Theory (10 Hours)

Theories of acids and bases: Arrhenius theory, Bronsted-Lowry theory, Conjugate acid base theory, dual behaviour of water, Lewis theory, Lux-Flood, Usanovich theory- pH , buffer solutions - significance of pH and buffer solution in biological system.

Concentration terms: Introduction- preparation of standard solutions- definition of equivalent weight and molecular weight- calculation of normality, molarity, molality, mole fraction.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
III/IV	Modern Inorganic Chemistry	R. D. Madan	S. Chand and Sons publications, 3 rd ed., 2014.
III/IV	Text book of Inorganic Chemistry	P. L. Soni and Mohan Katyal	S. Chand and Sons publications, 20 th ed., 2013.
I/II	Modern Organic Chemistry	M. K Jain and S. C .Sharma	Vishal publications, 4 th ed., 2016.

V	Principles of Physical Chemistry	B. R. Puri L. R Sharma and S. P. Madan	Vishal publications, 47 th ed., 2015.
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Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Principles of Inorganic Chemistry	B. R. Puri, L. R. Sharma and K.C. Kalia	Milestone publications, 33 rd ed., 2014.
2.	Text book of Organic Chemistry	Arun Bahl and B. S. Bahl	S. Chand and Sons publications, 22 nd ed., 2016.
3.	Concise Coordination Chemistry	R. Gopalan and V.Ramalingam	Vikas Publishing 2015

E-Resources : (Web resources & E-books)

- https://www.alchemyst.co.uk/pdf/Inorganic/coordination_chem.pdf
- [https://chem.libretexts.org/Textbook_Maps/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_\(Physical_and_Theoretical_Chemistry\)/Acids_and_Bases/Acid/Lewis_Concept_of_Acids_and_Bases](https://chem.libretexts.org/Textbook_Maps/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Acids_and_Bases/Acid/Lewis_Concept_of_Acids_and_Bases)
- <https://ocw.mit.edu/high-school/chemistry/exam-prep/structure-of-matter/chemical-bonding/#Ionic%20Bonds>
- <http://www.freebookcentre.net/>
- <http://www.unf.edu/~michael.lufaso/chem2045/>

Mapping of Course outcome with POs (For Physics)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	Bloom's Taxonomy level
CO1	H	M	M	M	M	M	-	A
CO 2	H	M	L	M	L	L	-	A
CO 3	H	M	L	M	M	M	-	A
CO 4	H	M	M	M	M	L	-	A
CO 5	H	M	L	M	M	M	-	A

Mapping of Course outcome with POs (For Mathematics)

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	M	M	M	L	M	A
CO 2	L	M	M	-	L	A
CO 3	L	M	M	L	M	A
CO 4	L	L	H	-	L	A
CO 5	M	M	M	L	M	A

Content Delivery Methods (Minimum Two):

- PPT and Video
- Demonstration
- Lecture Method

- Guest Lecture
- Group Assignments
- Visual Aids
- Problem solving
- Charts and posters
- Open Source

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Online test (For Mathematics) Quiz (For Physics)	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Online test (For Mathematics) Quiz (For Physics)	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 5 Questions	(5 X 1= 5 marks)
Section B	Either or Type - 5 Questions	(5 X 3= 15 marks)
Section C	Either or Type - 5 Questions	(5 X 6= 30 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (50)	CIA II (50)	Assignment (4)	Quiz/ Online test (4)
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50% (2 Mark) Presentation :25%(1 Mark)	R - 30% U - 40% A - 30%
U	40%	40%		
A	30%	30%		

Blue Print for End Semester Examination

Unit	Section A (5 x 1 = 5)					Section B (5 x 3 = 15)					Section C (5 x 6 = 30) T-Theory; P-Problems					
	MCQ															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
I	✓					T	T				T	T				
II		✓					T	T				T	T			
III			✓					T	T				T	T		
IV				✓					T	T				T	T	
V					✓					T	T				T&P	T&P

Course Designed	Dr. J. Bhuvanewari	
Course Reviewed	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B.Sc. Zoology Semester – I

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Allied I Chemistry I	Course Code: 117AZ1
Semester: I	No. of Credits: 3
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks: 50

(C: Contact Hours, T:Tutorial)

Course Objectives:

- To emphasize basic concepts of types of Chemical bonding and theories of Co-ordination chemistry.
- To understand the active roles played by metal ions and coordination compounds in biological systems.
- To know the important industrial applications of silicones, glass, fertilizers, soap and paints.
- To explain the reactivity of nucleophiles and electrophiles and to acquire basic principles and theories underlying electrochemistry
- To know the concepts in polymer and nuclear chemistry.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Define chemical bonding, Demonstrate the different types of chemical bonds and to Explain the fundamental concepts in co-ordination chemistry.	A
CO2	List out the sources for the manufacture of silicones, glass, fertilizers, soap, paints and Predict the important industrial applications of them.	A
CO3	Identify reaction intermediates, Express the types of polar effects, Recognize some common types of chemical reactions, and Explain the mechanism of electrophilic monosubstitution reaction.	A
CO4	Deduce the fundamentals of electrochemistry, Comprehend the term pH, buffer solution and illustrate the varied applications of pH, buffer solution in biological systems.	A
CO5	Discuss isotopes, isobars, isotones, Types of nuclear reactions, radioactive series, relate the applications of radioactivity in various	A

fields and Describe the types of polymerization, repeat units & structure of some individual polymers	
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R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Bonding and co-ordination Chemistry (11 Hours)

Bonding: Ionic, covalent, van der Waals and metallic—definition and examples Hydrogen bonding- definition, types and examples.

Co-ordination Chemistry: Introduction- definition of ligands and co-ordination number- classification of ligands- Nomenclature- Werner's co-ordination theory- Sidgwick's theory of effective atomic number- Pauling's theory- magnetic properties and interpretation of the following co-ordination compounds: $K_4[Fe(CN)_6]$, $[CoF_6]^{3-}$, $[Ni(CO)_4]$ - Application of co-ordination compounds in qualitative analysis (Cu, Fe and Ni).

Unit II: Industrial Chemistry (11 Hours)

Silicones: Definition, synthesis, properties and uses of silicones. Glass: definition- raw materials and manufacture of glass by tank furnace method composition and uses of soda glass, pyrex glass and safety glass. Fertilizers: urea, ammonium sulphate, ammonium nitrate, super phosphate of lime, triple super phosphate and potassium nitrate, Paints: definition, requisites and constituents of paints, Soaps: Introduction and types (manufacture not necessary).

Unit III: Organic Reactions (10 Hours)

Organic reaction intermediates: Electrophiles, nucleophiles and free radicals: - definition and examples. Polar effects: inductive effect, mesomeric effect and steric effect(basic concepts only).

Types of reactions: addition, substitution, elimination, rearrangement & polymerisation explanation with one example each (mechanism not necessary) - Electrophilic mono substitution reaction of benzene with mechanism— nitration and sulphonation reactions.

Unit IV: Electrochemistry (10 Hours)

Metallic and electrolytic conductors- Specific conductance and equivalent conductance- Arrhenius theory of electrolytic dissociation- Ostwald's dilution law, Kohlrausch's law and its applications and conductometric titrations- Galvanic cells- Standard electrode potential, electrochemical series- electroplating- Arrhenius theory of acids and bases - pH, buffer solutions - significance of pH and buffer solution in biological system.

Unit V: Polymer and Nuclear Chemistry (10 Hours)

Polymer chemistry: Types of polymerisation - addition and condensation- thermosetting and thermoplastics - Rubber- natural and synthetic- Fibers: nylon-6, polyesters, polyethylene, and polyvinylchloride.

Nuclear Chemistry: Definition and examples of isotopes, isobars and isotones- Half life

period - Group displacement law – n/p ratio- magic number- binding energy- radioactive series- Nuclear Fission and Fusion - applications of nuclear chemistry in medicine, agriculture and Carbon dating.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I, II, V	Modern Inorganic Chemistry	R. D. Madan	S. Chand and Sons publications, 3 rd ed., 2014.
IV	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma and S. P. Madhan	Vishal publications, 47 th ed., 2015.
III and V	Text book of Organic Chemistry	Arun Bahl and B. S. Bahl	S. Chand and Sons publications, 22 nd ed., 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Engineering Chemistry	P. C. Jain and Monika Jain	Dhanpat Rai Publications, 15 th ed., 2013.
2.	Text book of Inorganic Chemistry	P. L. Soni and Mohan Katyal	S. Chand and sons publications, 20 th ed., 2013.
	Principles of Inorganic Chemistry	B. R. Puri, L. R Sharma, and K.C. Kalia	Milestone publications, 33 rd ed., 2014.

E-Resources : (Web resources & E-books)

- <https://www.askiitians.com/iit-jee-chemical-bonding/>
- <https://www.chemistryabc.com/2018/06/chemical-bonding-full-notes-pdf.html>
- www.ncert.nic.in/ncerts/l/kech104.pdf
- <https://www.askiitians.com/iit-jee-co-ordination-compounds/>
- https://www2.chemistry.msu.edu/courses/cem151/chap24lect_2009.pdf
- chemistry.com.pk/free-download-chemistry-books

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO 1	M	L	L	M	M	A
CO 2	M	L	L	M	M	A
CO 3	M	L	L	M	M	A
CO 4	M	L	L	M	M	A
CO5	M	L	L	M	M	A

Content Delivery Methods (Minimum Two):

- Lecture Method
- Demonstration Class
- PPT and Video
- Open Source

- Flip Class
- Modeling a Concept

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Quiz	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Quiz	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 5 Questions	(5 X 1= 5 marks)
Section B	Either or Type - 5 Questions	(5 X 3= 15 marks)
Section C	Either or Type - 5 Questions	(5 X 6= 30 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (50)	CIA II (50)	Assignment (4)	Quiz (4)
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50% (2 Marks) Presentation :25% (1 Mark)	R - 30%
U	40%	40%		U - 40%
A	30%	30%		A - 30%

Blue Print for End Semester Examination

Unit	Section A (5 x 1 = 5)					Section B (5 x 3 = 15)										Section C (5 x 6 = 30) T-Theory									
	MCQ					6		7		8		9		10		11		12		13		14		15	
	1	2	3	4	5	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
I	✓					T	T							T	T										
II		✓						T	T							T	T								
III			✓						T	T								T	T						
IV				✓							T	T									T	T			
V					✓								T	T									T	T	

Course Designed	Dr. M. Indrani	
Course Reviewed	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Physics and Mathematics Semester – II/IV

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Allied II/IV Chemistry II	217AP2/417AM6
Semester: II/IV	No. of Credits: 3
No. of hours : 60	C:T: 52:8
CIA Max. Marks: 25	ESE Max. Marks: 50

(C:Contact Hours, T:Tutorial)

Course Objectives:

- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of the alloys.
- To obtain a unified view of chemical equilibrium and the direction of spontaneous change under the chemical potentials of bulk substances.
- To acquire basic principles and theories underlying surface chemistry, electrochemistry and science behind materials and metallurgy processes for a wide range of applications.
- To provide the student about principles and kinetic tools (factors) useful in analyzing the rates of chemical reactions.
- To acquaint the students with concepts of important photo physical, photochemical processes and their applications photosynthesis and photography.
- To equip with basic knowledge of polymers, nuclear structure of atoms, nuclear reactions and its applications also to provide students with a sound understanding of the underlying technology associated with nuclear plant.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Sketch and explain the basic concepts of phase rule, chemical equilibrium	A
CO2	Demonstrate the principles of surface chemistry, chromatography and electrochemistry	A
CO3	Illustrate the principles and process of metallurgy .	A
CO4	Integrate the rate equations and explain the laws/applications of photochemistry	A
CO5	Explain the basic concepts in nuclear chemistry and polymer chemistry	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Phase Rule and Chemical Equilibrium (11 Hours)

Phase rule- Phase, component and degree of freedom – definition - statement of phase rule and reduced phase rule- simple eutectic system – Lead - Silver system. Chemical equilibrium- rate of a reaction and law of mass action- chemical equilibrium and dynamic equilibrium- relation between K_p and K_c - application of law of mass action (N_2O_4 and $CaCO_3$)- Le-Chatelier principle and its application (NH_3 and NO_2).

Unit II: Surface Chemistry, Chromatography and Electrochemistry (10 Hours)

Introduction- physisorption and chemisorption- application- adsorption of gases by solids- Factors influencing adsorption - types of adsorption isotherms- Langmuir and B.E.T (basic concept only) theory of adsorption- Chromatography- principle, technique and uses of column chromatography and thin layer chromatography.

Metallic and electrolytic conductors- specific conductance and equivalent conductance– definition and derivation- Arrhenius theory of electrolytic dissociation- Ostwald’s dilution law- Kohlrausch’s law and conductometric titrations.

Unit III: Principles and Process of Metallurgy (10 Hours)

Minerals and ores- oxide and sulphide ores (any four examples)- various methods involved in metal extraction- grinding- pulverizing- ore dressing- gravity separation- magnetic separation- froth flotation- leaching- roasting- calcinations- smelting. Purification of metal - Van- Arkel method- electro refining- zone refining.

Unit IV: Chemical Kinetics and Photochemistry (11Hours)

Chemical Kinetics: Rate equation- Factors effecting rate of a reaction- Order and molecularity of a reaction- determination of order of reactions- derivation of rate constant and half - life period for zero order, first order and second order reactions - Effect of temperature on reaction rate and activation energy

Photochemistry: Laws- Stark – Einstein, Beer-Lambert- Grothus– Draper- examples and quantum efficiency of photochemical reactions- difference between photochemical and thermal reaction- photosensitization- fluorescence, phosphorescence and chemiluminescence- Applications of photochemistry – photosynthesis and photography.

Unit V: Nuclear and Polymer Chemistry (10 Hours)

Nuclear Chemistry: Definition and examples of isotopes, isobars and isotones- Half life period - group displacement law – n/p ratio- magic number- binding energy- radioactive series- Nuclear Fission and Fusion- Application of nuclear chemistry in medicine, agriculture, Carbon dating- nuclear reactor- atom bomb.

Polymer chemistry: Types of polymerisation - addition and condensation-thermosetting and thermoplastics – Rubber - natural rubber - vulcanisation - synthetic fibers: preparation and uses of nylon-6, polyesters.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I/II/IV	Text book of Physical Chemistry	B. R. Puri L. R. Sharma and S. P. Madhan	Vishal Publications 47 th ed. 2015
II	Text book of Organic Chemistry	Arun Bahl and B. S. Bahl	S. Chand and Sons publications 22 nd ed. 2016.
III/V	Modern Inorganic Chemistry	R. D. Madan	S. Chand and Sons publications, 3 rd ed., 2014.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Principles of Inorganic Chemistry	B. R. Puri, L. R Sharma, and K. C. Kalia	Milestone publications, 33 rd ed., 2014.
2.	Engineering Chemistry	P.C. Jain and Monika Jain	Dhanpat Rai Publications, 15 th ed., 2013.
3.	Elements of Analytical Chemistry	R. Gopalan, P. S. Subramanian and K. Rengarajan	S. Chand and Sons publications, 3 rd ed., 2016.

E-Resources : (Web resources & E-books)

- <https://www.chem.uci.edu/~lawm/263%206.pdf>
- <https://www.askiitians.com/revision-notes/chemistry/polymers/>
- <http://www2.onu.edu/~s-bates/chem172/lectureCh20.pdf>
- http://steelcast.ru/d/80122/d/fundamentals_of_metallurgy.pdf
- <https://www.alchemyst.co.uk/pdf/Physical/photochemistry.pdf>
- <https://nptel.ac.in/courses/122101001/35>

Mapping of Course outcome with POs (For Physics)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	Bloom's Taxonomy level
CO1	H	M	L	M	M	L	-	A
CO 2	H	M	L	L	M	M	-	A
CO 3	H	L	L	L	M	L	-	A
CO 4	H	M	L	L	M	M	-	A
CO 5	H	M	L	L	M	M	L	A

Mapping of Course outcome with POs (For Mathematics)

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	L	L	L	L	-	A
CO 2	L	M	L	L	-	A
CO 3	L	L	L	L	-	A
CO 4	L	L	M	L	-	A
CO 5	L	L	M	L	L	A

Content delivery methods (Minimum Two):

- PPT and Video

- Demonstration
- Guest Lecture
- Practical session
- Models
- Problem solving,
- ICT Enabled Class.

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Quiz	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Quiz	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 5 Questions (5 X 1= 5 marks)
Section B	Either or Type - 5 Questions (5 X 3= 15 marks)
Section C	Either or Type - 5 Questions (5 X 6= 30 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I 50	CIA II 50	Assignment 4	Quiz 4
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50% (2 Marks) Presentation :25% (1 Mark)	R - 30%
U	40%	40%		U - 40%
A	30%	30%		A - 30%

Blue Print for End Semester Examination

Unit	Section A (5 x 1 = 5)					Section B (5 x 3 = 15)										Section C (5 x 6 = 30) T-Theory									
	MCQ					6		7		8		9		10		11		12		13		14		15	
	1	2	3	4	5	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
I	✓					T	T							T	T										
II		✓						T	T							T	T								
III			✓							T	T							T	T						
IV				✓								T	T									T	T		
V					✓									T	T									T	T

Course Designed by	Dr.J.Bhvaneswari
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Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

B. Sc Zoology Semester – II

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Allied II Chemistry II	Course Code: 217AZ2
Semester: II	No. of Credits: 3
No. of hours : 60	C:T: 52:8
CIA Max. Marks: 25	ESE Max. Marks:50

(C: Contact hours, T:Tutorial)

Course Objectives:

- To study the structure & properties of carbohydrates and biological function of vitamins.
- To study the structure & properties of proteins, amino acids and nucleic acids.
- To acquire the knowledge on renewable and non-renewable energy sources.
- To understand the fundamentals of chromatography, photochemistry and chemotherapy.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Appreciate the importance of structure, composition, biological functions of simple sugars and to Identify foods that contain vitamins they need daily and analyse the importance of vitamins that are essential to the healthy functioning of the human body	A
CO2	Demonstrate amino acid structures, describe their physical and chemical properties, define primary, secondary structure in proteins, their biological significance and Indicate about the structure and nature of DNA and RNA	A
CO3	Investigate resources, distinguish between renewable and nonrenewable resources, Infer knowledge about liquid fuels and gaseous fuels	A
CO4	Discuss the theoretical basis of photochemistry and the concepts associated with the principles and applications of chromatography	A
CO5	Draw the structure, interpret the mode of action and justify the uses of some drugs such as antipyretics, analgesics, sulpha-drugs, antibiotics etc.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Carbohydrates and Vitamins	(11 Hours)
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Carbohydrates: Classification- Glucose and fructose – preparation, properties and inter conversion of glucose to fructose and vice-versa- open chain structure for glucose- biological functions of glucose- preparation, properties and uses of sucrose- test for carbohydrates.

Vitamins: definition, sources and importance - Biological activities and deficiency diseases of Vitamin A, B, C, D, E and K.

Unit II: Amino acids, Proteins and Nucleic Acids (10 Hours)

Amino acids: Introduction- Classification, preparation, properties and uses of glycine- Polypeptide: Synthesis of peptides by carbobenzoxy method.

Proteins: Introduction and classification according to composition and function- Biological functions of proteins- Primary and Secondary structures of proteins, test for proteins and uses- Nucleic acids: Introduction- Types- Structure of DNA- Distinction between DNA and RNA.

Unit III: Renewable and Non-Renewable Energy Sources (11 Hours)

Renewable energy sources: Definition and examples- applications of solar energy- solar water heater, solar cooker and solar-silicon cell- wind energy – description of wind mill, its component and uses (elementary idea only).

Non-renewable energy sources: definition- liquid fuels– Petroleum– origin, composition, refining and fractionation of petroleum- Gaseous fuels: introduction, classification and requisites- water gas- composition, manufacture and uses- L.P.G. - composition and uses.

Unit IV: Chromatography and Photochemistry (10 Hours)

Chromatography: Introduction- Thin layer chromatography and Column chromatography– principle, technique and applications.

Photochemistry: Stark – Einstein's, Beer-Lambert, Grothus– Draper Laws - examples and quantum efficiency of photochemical reactions- difference between photochemical and thermal reaction- photosensitization- fluorescence, phosphorescence and chemiluminescence- applications of photochemistry – photosynthesis and photography.

Unit V: Chemotherapy (10 Hours)

Drug– definition of the following terms – drug, pharmacology, toxicology, chemotherapy, bacteria, virus, LD₅₀, ED₅₀ and therapeutic index.

Sulpha drugs: Preparation and uses of sulphanilamide and sulphapyridine.

Analgesics and Antipyretics- Introduction and mode of action- synthesis and uses of aspirin and paracetamol

Antibiotics- Introduction, structure, mode of action and uses of Penicillin, Streptomycin Chloramphenicol and Tetracycline, (Synthesis and structural elucidation not necessary).

Antimalarial- Introduction and classification- synthesis and uses of chloroquine, primaquine.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I, II, V	Text book of pharmaceutical chemistry	Jayashree ghosh	S. Chand and Sons publications, 3 rd ed., 2014
IV	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma and S. P. Madhan	Vishal publications, 47 th ed., 2015.
III, IV	Industrial chemistry	B.K. Sharma	Goel publications, 12 th ed., 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Advanced Organic Chemistry	Arun Bahl and B. S. Bahl	S.Chand and Sons publications, 3 rd ed., 2014.
2.	Engineering Chemistry	P.C. Jain and Monika Jain	Dhanpat Rai Publications, 15 th ed., 2013.
3.	Modern Organic Chemistry	M. K. Jain and S. C. Sharma	Vishal Publications, 4 th ed., 2016.

E-Resources : (Web resources & E-books)

- <https://www.askiitians.com/iit-jee-carbohydrates-amino-acids.../carbohydrates/>
- <https://nptel.ac.in/courses/104103071/pdf/mod11.pdf>
- <https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/carbyhd.htm>
- ncert.nic.in/ncerts/l/lech207.pdf
- <https://schools.aglasem.com/55699>
- <https://hemantmore.org.in/foundation/science/chemistry/everyday-medicines/2169/>
- <https://www.khanacademy.org/.../proteins...amino-acids/.../introduction-to-proteins-an...>
- <https://study.com/academy/topic/basics-of-dna-rna.html>
- <https://www.svce.ac.in/departments/.../UNIT%20III%20-%20Photochemistry.pdf>
- <https://www.btechguru.com/prepare--anna-university--computer-science-and-engineer...>
- www.explainthatstuff.com/chromatography.html
- colgurchemistry.com/Chem11/Study Guide for Final Exam.pdf

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO 1	H	L	L	H	M	A
CO 2	H	L	L	H	M	A
CO 3	H	L	L	H	M	A

CO 4	H	L	L	H	M	A
CO5	H	L	L	H	M	A

Content Delivery Methods (Minimum Two):

- Lecture Method
- Demonstration Class
- PPT and Video
- Open Source
- Gallery walk

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Quiz	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Quiz	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 5 Questions	(5 X 1= 5 marks)
Section B	Either or Type - 5 Questions	(5 X 3= 15 marks)
Section C	Either or Type - 5 Questions	(5 X 6= 30 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I (50)	CIA II (50)	Assignment (4)	Quiz (4)
R	30%	30%	Overall Structure: 25% (1 Mark) Content : 50% (2 Marks) Presentation :25% (1 Mark)	R - 30%
U	40%	40%		U - 40%
A	30%	30%		A - 30%

Blue Print for End Semester Examination

Unit	Section A (5 x 1 = 5)					Section B (5 x 3 = 15)					Section C (5 x 6 = 30) T-Theory								
	MCQ																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15				
						a	b	a	b	a	b	a	b	a	b	a	b	a	b
I	✓					T	T					T	T						
II		✓					T	T				T	T						
III			✓					T	T					T	T				
IV				✓					T	T						T	T		
V					✓					T	T							T	T

Course Designed by	Dr. M. Indrani	
Course Reviewed by	Mrs. M. Malarvizhi	
Head of the Department	Mrs. M. Malarvizhi	

**B.Sc Physics, Zoology and Mathematics
Semesters – I and II / III and IV**

(For the students admitted from the academic year 2017 – 2018 onwards)

Course: Part III Allied Chemistry Practical	Course Code: 217APP/217AZP/ 417AMP
Semesters: I and II / III and IV	No. of Credits:2
No. of hours : 60	P: R 50: 10
CIA Max. Marks: 20	ESE Max. Marks:30

(P: Practical hours, R: Record and observation work)

Course Objectives:

- To impart sound theoretical knowledge in volumetric and organic analysis.
- To expose the students to laboratory hygiene and safety methods.
- To enhance the skill of handling chemicals, glass wares and apparatus used in volumetric and organic analysis.
- To acquire skills of doing quantitative estimations by titrimetry.
- To provide basic knowledge and skills for simple reactions in organic chemistry.
- To determine the functional group of an unknown compound.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Gain sound theoretical knowledge in volumetric and organic analysis.	U
CO2	Implement laboratory hygiene and safety methods.	A
CO3	Analyze the given solution by Volumetric analysis and the unknown substance by Organic analysis	A

R-Remembrance U –Understanding A-Apply

Syllabus:

<p>A. Volumetric analysis:</p> <p>I. Acidimetry and alkalimetry Estimation of sodium carbonate Estimation of hydrochloric acid Estimation of oxalic acid</p> <p>II. Permanganometry Estimation of oxalic acid Estimation of ferrous sulphate Estimation of Mohr's salt</p> <p>III. Iodometry (Demonstration)</p>
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Estimation of potassium dichromate
Estimation of copper

B. Organic analysis

Detection of elements (N, S and halogens)

To identify aliphatic and aromatic, saturated and unsaturated compounds.

Functional group - tests for phenols, aromatic acids, amines, amides and carbohydrates.

Books for study:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Basic Principles of Practical Chemistry	V. Venkateswaran, R. Veeraswamy, and A. R. Kulandaivelu.	S. Chand and Sons publications, 2 nd ed., 2016.
2.	Vogel's Text Book of Practical Organic Chemistry	B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell	Pearson Edn., Ltd., 5 th ed., 2009

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/122101001/37>
- <https://nptel.ac.in/courses/103108124/17>
- <http://vlab.amrita.edu/?sub=2&brch=191>

Mapping of Course outcome with POs (For Physics)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	Bloom's Taxonomy level
CO1	H	H	L	H	H	-	-	U
CO 2	-	-	H	H	-	-	-	A
CO 3	H	H	L	H	H	-	-	A

Mapping of Course outcome with POs (For Mathematics)

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	-	-	-	-	-	U
CO 2	-	-	-	-	-	A
CO 3	-	L	L	L	-	A

Mapping of Course outcome with Pos (For Zoology)

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO 1	-	H	-	H	-	U
CO 2	-	H	-	H	-	A
CO 3	-	H	-	H	-	A

Content delivery Methods (Minimum Two):

- Lecture method
- Power point presentation
- Visual aids
- Demonstration
- Virtual Laboratory

- Problem Solving

Course Evaluation Methods:

Direct Methods	Indirect Methods
Lab Performance Record Model Examination	Course Exit Survey

Internal Assessment components:

Components	Lab Performance	Record	Model	Attendance	Total
Marks	7	7	4	2	20

Question Paper Pattern

Section A	Volumetric Analysis (15 Marks)
Section B	Organic Analysis (13 Marks)
Section C	Viva Voce (02 Marks) Questions will be asked from CO1, CO2 and CO3

Evaluation will be made based on Weightage % given

Bloom's Category	Lab performance (7)	Record (7)	Model Examination
A	Punctuality, Safety and Hygiene : 50% (3.5Marks) Experimental Skill and Observation Note : 50% (3.5 Marks)	Punctuality & Neatness : 43 % (3 Marks) Calculations & Accuracy: 57 % (4 Marks)	Model Examination Marks converted to 4 marks

ESE Assessment components:

Volumetric analysis	: 15 Marks
Organic Analysis	: 13 Marks
Viva Voce	: 02 Marks
Total	: 30 marks
Scheme of valuation:	
1. Volumetric analysis: 15 Marks	
Volumetric Error upto 2%	15 Marks
Error upto 2-3%	12 Marks
Error upto 2-3%	10 Marks
Above 4%	8 Marks
2. Organic Analysis: 13 Marks	
Element Present/ absent correctly reported	3 x 1 - 3 Marks
Aliphatic/ Aromatic	2 x 1 - 2 Marks
Saturated/ unsaturated	3 x 1 - 3 Marks
Preliminary test	- 3 Marks
Functional group	- 2 Marks
3. Viva Voce: 2 Marks	

(Questions will be asked from CO1, CO2 and CO3)

Course Designed by	Mrs. R.Chitradevi	
Course Reviewed by	Mrs.S.Umadevi	
Head of the Department:	Mrs.M.Malarvizhi	