



PSGR  
Krishnammal College for Women



**DEPARTMENT OF CHEMISTRY**

**CHOICE BASED CREDIT SYSTEM &  
OUTCOME BASED EDUCATION SYLLABUS**

**BACHELOR OF CHEMISTRY**

**2022 - 2023**



## PROGRAMME OUTCOMES

After completion of the programme, the student will be able to

- PO1** : accept the common responsibility to preserve the environment and to contribute to the development of societal concerns.
- PO2** : acquire communication skill- written, verbal and digital
- PO3** : demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating to the subject areas namely organic, inorganic, physical, analytical chemistry, Mathematics, Physics and Biology.
- PO4** : apply such knowledge and understanding to the solution of qualitative and quantitative problems of familiar and unfamiliar.
- PO5** : handle chemical materials safely by taking into account their physical and chemical properties including any specific hazards associated with their use.
- PO6** : conduct standard laboratory procedures for the synthesis and analysis of organic, inorganic systems, monitor, record document in a reliable manner, chemical properties, events and changes by observation and measurement.

## PROGRAMME SPECIFIC OUTCOME

The students at the time of graduation will

- PSO1** : possess skills in safe handling of chemicals taking into account their physical and chemical properties
- PSO2** : be able to employ critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments, at a level suitable to succeed at an entry-level position in chemical industry or a chemistry graduate program.
- PSO3** : be able to apply the theoretical concepts of instruments that are commonly used in most chemistry fields as well as interpret and use data generated in instrumental chemical analyses.



DEPARTMENT OF CHEMISTRY

2022-2025 BATCH

SEM	Part	Subject Code	Title of the Paper		Instruction hours/week	Contact hours	Tutorial	Duration of Examination	Examination Marks			Credits
									CA	ESE	TOTAL	
I	I	TAM2201/ HIN2201/	Language T/H/F Paper I	Language	6	86	4	3	50	50	100	3
	II	ENG2201/	English Paper-I	English	6	86	4	3	50	50	100	3
	IIIA	CE22C01	General Chemistry Paper - I	CC	6	86	4	3	50	50	100	5
	IIIA	CE21CP1	Chemistry Practical - I	CC	3	45	-	-	-	-	-	-
	IIIA	PS22A01/ TH22A01	IDC Allied Physics Paper - I	GE	4	56	4	3	30	45	75	4
			IDC Allied Mathematical Statistics I with R	GE	7	101	4	3	50	50	100	5
	IIIA	PS21AP1	Allied Physics Practical	GE	3	45	-	-	-	-	-	-

	IV	NME19B1/ NME19A1/ NME12WS/ NME12AS/ NME12GS/ NME21ES/ NM221KS	Basic Tamil / Advanced Tamil / Women Studies/ Ambedhkar Studies/ Gandhian Studies/NEN- Introduction to Entrepreneurship/Indian Knowledge System	AEC	2/2/ 2	28/26/ 26	2/4/4	-/2/-	50/ 50/ 100	50/ 50/-	100/ 100/ 100	2	
II	I	TAM2202/ HIN2202/	Language T/H/F Paper - II	Language	6	86	4	3	50	50	100	3	
	II	ENG2202	English Paper-II	English	5	86	4	3	50	50	100	3	
	IIIA	CE22C02	General Chemistry Paper - II	CC	5	71	4	3	50	50	100	5	
	IIIA	CE21CP1	Chemistry Practical I	CC	3	45	-	3	50	50	100	4	
	IIIA	PS22A02/ TH22A02	IDC Allied Physics Paper - II  IDC Allied Mathematical	GE	5	71	4	3	30	45	75	4	
	IIIA	PS21AP1	Allied Physics Practical	GE	3	45	-	3	25	25	50	2	
	IV		Open Course - Self Study Online Courses		-	-	-	-	-	-	-	-	
	IV	NME19B2/ NME19*A2	Basic Tamil/Advanced Tamil**	AEC	-	-	-	-	-	-	-	-	
	V	21PELS1	Professional English (Science /Management/ Humanities/Commerce)	AEC	3	45	3		50	50	100		
	IIIB	NM12GAW	Foundation Course –1 (General Awareness)		Self-study (Online)								Grade
III	I	TAM2203/ HIN2203/ ENG2202	Language T/H/F Paper III	Language	6	88	2	3	50	50	100	3	

	II	ENG2203	English Paper-III	English	5	73	2	3	50	50	100	3
	IIIA	CE22C03	General Chemistry Paper III	CC	4	58	2	3	50	50	100	4
	IIIA	CE22CP2	Chemistry Practical - II	CC	3	45	-	-	-	-	-	-
	IIIA	TH22A09/ PL22A04/	Allied Mathematics for Sciences I  [OR]	GE	7	103	2	3	50	50	100	5
	IIIA	PL22AP1/ AS22AP1	Allied Practical – Botany/Zoology	GE	3	45	-	-	-	-	-	-
	IIIA	CE22SB01	Skill based subject Computational chemistry-I	SEC	3	41	4	2	100	-	100	3
	III B	NM22EVS	Foundation Course-II (Environmental Studies) *	AECC	Self- study	-	-	-	100	-	100	Grade
	III B	NM22UHR	Foundation Course-III (Universal Human Values and Human Rights) *	AECC	2	28	2	-	100	-	100	2
	VI	JOB1334	Job Oriented Course		After 12.30 PM		GRA DE*					

SEM	Part	Subject Code	Title of the Paper		Instruction hours/week	Contact hours	Tutorial	Duration of Examination	Examination Marks			Credits
									CA	ESE	TOTAL	
IV	I	TAM2204/ HIN2204/	Language T/H/F Paper – IV	Language	6	88	2	3	50	50	100	3
	II	ENG2204	English Paper IV	English	5	73	2	3	50	50	100	3
	III	CE22C04	General Chemistry Paper – IV	CC	4	58	2	3	50	50	100	4
	III	CE21CP2	Chemistry Practical II	CC	3	45	-	3	50	50	100	5
	III	TH22A10/ PL22A02/	Allied Mathematics for Sciences II/		7	103	2	3	50	50	100	5
	III	PL21AP1/ AS21AP1	Allied Practical – Botany/Zoology	GE	3	45	-	3	50	50	100	2
	III	CE22SB02/ CE21SBCE	Skill based subject- Computational Chemistry-II / Coursera course (Environmental Chemistry and	SEC	3	43	2	2	25	75	100	3
	III	CE22SBP1	Skill based subject- Computational Chemistry Practical	SEC	3	45	-	3	50	50	100	2
	IV	NM21DTG	Design Thinking	Finishing School	2	30		-	-	100		2
	V		Extension Activities NSS/NCC/YRC/Sports & Games/Ecowatch/YiNet/Rotract/ED Cell	AEC	-	-	-	-	-	100		1

CC – Core Courses, CA – Continuous Assessment, GE – Generic Elective, ESE - End Semester Examination,

AEC – Ability Enhancing Course

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
CE22C01	GENERAL CHEMISTRY PAPER - I	THEORY	86	4	-	5

### Preamble

To enable the students to

- understand quantum mechanics as a mathematical model to produce wave functions and energies
- learn about the fundamental ideas, physical significance and theories of bonding in molecules
- gain knowledge about the polar effects and their importance in affecting the properties of compounds
- understand the principles of thermodynamics and thermo chemistry
- explore Industry 4.0 through physical-to-digital-to-physical connection which potentially transform the chemical industry

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	understand the basics of quantum mechanics, bonding, reactive intermediates, thermodynamics and Industry 4.0	K1
CLO2	discuss the atomic structure, types of bonding, electronic effects on reactivity, stability of aromatic compounds and state / path function using thermodynamics	K2
CLO3	examine the periodic properties, strength of bonding, and apply the principles in identifying reaction mechanism. Apply laws of thermodynamics and learn the physical processes involved. Practice to understand the concepts of Industry 4.0	K3
CLO4	Analyze and perform calculations on periodic properties, Aromaticity, bonding theories, thermodynamic and thermochemistry principles.	K4

### Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	H	H	H
CLO2	H	H	M	H	H
CLO3	H	H	H	H	H
CLO4	H	H	M	H	H

H-High; M-Medium; L-Low

## GENERAL CHEMISTRY PAPER – I (CE22C01)

(86 Hrs)

### Unit I

(17hrs)

#### Atomic Structure

Wave mechanical concepts of Rutherford's Nuclear model of the atom and its limitations. Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Atomic orbitals. Schrodinger wave equation, Significance of  $\psi$  and  $\psi^2$  (no derivation required), shapes of s,p,d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Quantum numbers - Electronic configuration of elements, effective nuclear charge.

#### Periodic Properties

Atomic and ionic radii, ionization energy, electron affinity and electronegativity – definition, factors determining ionization energy and electro negativity, and their applications.

### Unit II

(17hrs)

#### Chemical Bonding & Molecular Structure

Introduction to different types of Bonding- Covalent bonding - Valence bond theory and its limitations, Hybridisation - Types of overlap of atomic orbitals. Valence shell electron pair repulsion theory (VSEPR) to  $\text{BF}_3$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{ClF}_3$ ,  $\text{SF}_4$ ,  $\text{PF}_5$ ,  $\text{SF}_6$ .

Concept of resonance and resonating structures for  $\text{CO}_3$  and  $\text{CO}$ .

**MO theory-** Introduction, bonding and magnetic properties (for simple homo nuclear and hetero nuclear diatomic molecules)

**Ionic bonding-** Factors influencing the formation of ionic bonding. Ionic crystals  $\text{NaCl}$ ,  $\text{CsCl}$ . Lattice energy of ionic crystals, statement of Born-Lande equation for calculation of ionization energy, Born-Haber cycle and its application, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Hydrogen bonding-Types with examples. Vanderwaal's forces and London forces.

**Co-ordinate covalent bond-**with examples, Comparison between ionic, covalent and coordinate bonding.

### Unit III

(17hrs)

#### Thermodynamics-I

Definitions of terms involved, extensive and intensive properties, path functions vs state functions, exact and inexact differentials. First law of thermodynamics, adiabatic and isothermal processes,



reversible and irreversible processes - Work done, Joule- Thomson effect, Joule Thomson Coefficient –Problems.

### **Thermo chemistry**

Heat of neutralization, heat of solution, heat of combustion. Bomb calorimeter, determination of heat of combustion, heat of dilution. Integral and differentials. Hess's law- calculation of bond energy, bond length, dissociation energy, Kirchoff's equation- applications.

### **Unit IV**

**(17hrs)**

#### **Fundamental aspects of Organic reaction mechanisms**

Nucleophiles and electrophiles, Reactive Intermediates: Carbocations, Carbanions and free radicals- Formation, structure and stability. Inductive Effect, Electromeric Effect, Resonance and Hyper conjugation, (Baker - Nathan effect), Steric effect-examples and effect on reactivity. Comparison of acid strength-halogen substituted acids. Basic strength of  $\text{RNH}_2$ ,  $\text{R}_2\text{NH}$ ,  $\text{R}_3\text{N}$  and aniline and stability of alkenes based on hyper conjugation.

Cycloalkanes-Nomenclature, methods of preparation, chemical reactions, Baeyer's strain theory and its limitations.

### **Unit V**

**(18hrs)**

#### **Aromaticity**

Structure of benzene, Dewar structure, isomer number, resonance structure of benzene. Kekule structure, resonance energy and stability of benzene, reactions of benzene, orbital picture of benzene, aromatic character- Huckel's rule, non-benzenoid aromatic compounds.

Aromatic electrophilic substitution- mechanism of nitration, sulphonation, halogenation,

Friedel craft's alkylation, acylation and diazonium coupling

#### **Industry 4.0**

Introduction to Industry 4.0- Need – Reasons for Adopting Industry 4.0 - Definition – Goals Technologies of Industry 4.0- Applications of Artificial Intelligence in chemistry for predicting the properties of molecular structure – Chem sketch, Chem Draw, MOPAC, Avagadro.

## Text Books

S. No	Author	Title of the Book	Publishers	Year of Publication
1	ArunBahl B. S. Bahl	Advanced Organic Chemistry	S. Chand Sons Company Pvt Ltd	2016
2	Jagdamba Singh	Undergraduate Organic Chemistry Vol I	PragathiPrakahasan	2010
2	P. L. Soni	Text Book of Inorganic Chemistry	Sultan Chand and Sons	2013
4	B. R. Puri, L. R. Sharma, M. S. Patania	Principles of Physical Chemistry	Vishal Publishing & Co	2017
5	P. Kaliraj, T. Devi,	Higher Education for Industry 4.0 and Transformation to Education 5.0		

## Reference Books

S. No	Author	Title of the Book	Publishers	Year of Publication
1	B. R. Puri, L. R. Sharma, K. K. Kalia	Principles of Inorganic Chemistry	Milestone Publishers and Distributors	2011
2	R. T. Morrison and R. N. Boyd	Organic Chemistry	Pearson India Education Services	2010
3	R. D. Madan	Modern Inorganic Chemistry	S. Chand Sons Company Pvt Ltd	2014
4	Alasdair Gilchrist.	Industry 4.0: The Industrial Internet of Things, Apress Publications		

## Related Online References:

1. Introduction to Industry 4.0 and Industrial Internet of Things by Prof.Sudip Mishra, IIT Kharagpur.
2. A Complete Guide to Industry 4.0-Udemy

## Pedagogy:

Lecture by chalk and talk, power point presentation, e-content, Numerical exercise, group discussion, assignment, quiz, peer learning, seminar

## Course Designers

1. Dr. N. Shyamala Devi
2. Dr. S. Jone Kirubavathy

## Question Paper Pattern

### End Semester Examination: 100 Marks

BLOOM'S CATEGORY	SECTION	WORD LIMIT	MARKS	TOTAL
K1, K2	A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	100
K1, K2	B - 5 x 6 Marks ( Either/or)	300	30	
K3, K4	C – 5x 12Marks ( Either/or)	600-800	60	

### Continuous Internal Assessment: 50 Marks

SECTION	MARKS	TOTAL
A - 3 X 2 Marks (No Choice)	6	50
B - 3 X 5 Marks (Internal Choice at same CLO Level)	15	
C - 3 X 8 Marks (Internal Choice at same CLO Level)	24	

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
CE22A01	<b>IDC - CHEMISTRY FOR BIOLOGISTS– I</b> (Offered to B.Sc Botany/Zoology/Biotechnology)	THEORY	56	4	-	4

### Preamble

To enable the students to

- gain knowledge about the nature of bonding and hybridization
- learn the importance of aromaticity and isomerism
- understand the preparation of standard solutions and chromatographic techniques
- acquire knowledge on the significance of aminoacids and proteins
- familiarize the applications of solar energy and water treatment techniques

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the types of bonding , organic reagents, aminoacids and define the terms involved in analytical /environmental chemistry	K1
CLO2	Understand the concept of hybridization, classify aromatic/non-aromatic compounds, aminoacids/proteins and demonstrate the preparation of standard solutions.	K2
CLO3	Interpret the structure & stereo isomerism of organic compounds and illustrate the importance of chromatographic techniques/renewable sources and water treatment technologies	K3
CLO4	Appraise the theories of bonding, conformational analysis and experiment the role of analytical techniques and softening process in various applications	K4

### Mapping with programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	H	H	H
CLO2	H	H	H	H	H
CLO3	H	H	H	H	H
CLO4	H	H	H	H	H

H- High; M-Medium; L-Low

## **IDC – CHEMISTRY FOR BIOLOGISTS - I (CE22A01)**

**(Offered to B.Sc Botany / Zoology / Biotechnology) (56 hrs)**

### **UNIT I (11 hrs)**

#### **Bonding**

Types of bonding - Covalent bond - nature, structure and hybridization of CH<sub>4</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub> and C<sub>6</sub>H<sub>6</sub> molecule. Ionic bond - Nature of ionic bond, structure of NaCl and CsCl. Hydrogen bonding - inter and intra molecular, nature and its effect on its structure and its consequences. Shapes and hybridization of BeCl<sub>2</sub>, H<sub>2</sub>O, NH<sub>3</sub> and PCl<sub>5</sub> based on VSEPR theory.

### **UNIT II**

#### **Organic reactions and Stereoisomerism**

Types of organic reagents - electrophiles, nucleophiles and free radicals.

Aromaticity - Huckel's rule, mechanism of nitration, sulphonation, halogenation, Friedel craft's alkylation and acylation of benzene.

Stereoisomerism - geometrical isomerism (cis - trans isomerism only), optical isomerism (lactic acid and tartaric acid). Conformation - a simple treatment of ethane and n-butane.

### **UNIT III**

#### **Analytical Chemistry**

Role and importance of analytical chemistry –principle of volumetric analysis - calibration of glasswares, standardization - experimental requirements -concentration units (normality and molarity) –types and preparation of standard solutions (primary and secondary standards). Types of titrations - indicators for acid-base titrations. Chromatography– principle and classification- paper, column, thin layer, electrophoresis and ion-exchange chromatography and its applications.

### **UNIT IV**

#### **Amino acids and Proteins**

Amino acids -classification, preparation of amino acids by Gabriel phthalimide synthesis, Erlen Meyer azlactone synthesis. Properties of amino acids and action of heat on  $\alpha$ ,  $\beta$ ,  $\gamma$  amino acids -dipeptide synthesis. Protein- classification according to composition and function, primary and secondary structures, properties and colour reactions of proteins.

### **UNIT V**

#### **Solar energy and Water treatment**

Solar energy -renewable energy and non - renewable energy sources - solar energy - solar cells, solar heating, solar collector (flat plate collector only), applications.

Water treatment - hardness of water- temporary and permanent hardness, disadvantages of hard water.

Softening methods - reverse osmosis, zeolite and demineralization process. Purification of water for domestic purpose - disinfection by chlorine, ozone and UV light.

**Text Books :**

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1.	Dr. V. Veeraiyan	Textbook of Allied Chemistry	High mount Publishing house, triplicane, Chennai.	Reprint 2006
2.	R. Gopalan. P.S. Subramanian and K. Rengarajan	Elements of Analytical Chemistry	Sultan Chand & Sons, Educational Publishers, New Delhi	Reprint 2013
3.	Arun Bahl B. S. Bahl	Advanced Organic Chemistry	S. Chand Sons Company Pvt Ltd,	Reprint 2009
4.	P.C Jain & Monika Jain	Engineering chemistry	Dhanpat Rai Publishing Co Pvt Ltd.	Reprint 2003

**Pedagogy:**

Lecture by chalk and talk, power point presentation, e-content, numerical exercise, group discussion, assignment, quiz, peer learning, seminar

**Course Designers**

1. Dr.R.Revathi
2. Dr.N.Anusuya

**Question Paper Pattern**

**End Semester Examination**

BLOOM'S CATEGORY	SECTION	WORD LIMIT	MARKS	TOTAL
K1, K2	A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	100
K1, K2	B -5 x 6 Marks ( Either/or)	300	30	
K3, K4	C – 5x 12Marks ( Either/or)	600-800	60	

COURSE NUMBER	COURSE NAME	Category	L	T	P	Credit
CE22A03	IDC – ALLIED CHEMISTRY PAPER –I (offered to B.Sc Physics)	Theory	56	4	-	4

### Preamble

To enable the students to

- understand the concepts of organic chemistry
- gain knowledge about the theories of chemical bonding.
- understand the different terms in phase rule and its applications
- learn the concepts of chemical kinetics, photo chemistry, solid state chemistry.

### Course Outcomes

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

CLO Number	CO Statement	Knowledge Level
CLO1	recollect the types of bonding, classify organic reactions, types and examples of solutions, the terminologies in thermodynamics, and the basics on the rate of a chemical reaction	K <sub>1</sub>
CLO2	relate the electronic factors that influence organic reactions, the types of chemical bonding with its effect on structure and property, law of thermodynamics on systems, theories of chemical kinetics & photo chemistry, elements of symmetry in crystal lattice	K <sub>2</sub>
CLO3	apply the concept of hybridization to organic molecules, theories of bonding in predicting the structure of a molecule, laws of thermodynamics to analyze the feasibility of reactions, concept of energy of activation on reaction rate, laws in explain the ideal behavior of solutions	K <sub>3</sub>
CLO4	analyze the nature of the organic molecule based on its hybridization, electronic effect, predict the conducting behavior of materials, calculate the enthalpy, bond energy, entropy of a system, construct the phase diagram of simple eutectic system and analyze the typical crystal lattices	K <sub>4</sub>

### Mapping with Programme Outcomes

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	M	H	H	M	M	M
CLO2	M	H	H	M	M	M
CLO3	M	H	H	M	M	M
CLO4	M	H	H	M	M	M

H- High; M-Medium; L-Low

## IDC – Allied Chemistry Paper –I (For B.Sc Physics) CE22A03 (56 Hrs)

### UNIT I (11hrs)

#### Basics of Organic Chemistry

Classification of organic compound- types of reagents- electrophiles, nucleophiles and free radicals, Classification of reactions - addition, substitution, elimination, condensation, polymerisation and rearrangements, polar effects, inductive effect, resonance, hyper-conjugation. steric effect.

Hybridization and geometry of organic molecules -  $\text{CH}_4$ ,  $\text{C}_2\text{H}_4$ ,  $\text{C}_2\text{H}_2$ ,  $\text{C}_6\text{H}_6$  molecules, structure of graphite and diamond.

### UNIT II (11hrs)

#### Chemical Bonding

Ionic bond- nature of ionic bond, structure of  $\text{NaCl}$ ,  $\text{KCl}$  and  $\text{CsCl}$ , factors influencing the formation of ionic bond. Covalent bond-nature of covalent bond, structure and shapes of  $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{PCl}_5$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{IF}_7$  based on VSEPR theory and hybridization. Hydrogen bonding - inter and intra molecular, nature and its effect on structure and properties. Vander Waal's forces- dipole-dipole, dipole-induced dipole interactions. Metallic bonding-semiconductors - intrinsic, extrinsic n-type and p-type semiconductors.

### UNIT III (11 hrs)

#### Energetics

Definition of certain terms - system, surrounding, reversible and irreversible process, First law of thermodynamics, limitations of I law, need for II law - different statements of II law - Carnot cycle - efficiency - Carnot theorem - thermodynamic scale of temperature –Joule-Thomson effect- enthalpy - bond energy – definitions of entropy and free energy.

### UNIT IV (11 hrs)

#### Chemical Kinetics & Photochemistry

Chemical kinetics- order and molecularity, rate expression for I, II and III order (derivation not required), methods of determining order of a reaction.

Concept of energy of activation and Arrhenius equation, effect of temperature on reaction rate. Catalysis- homogeneous and heterogeneous catalysis, theories of catalytic activity, catalyst used in industrial processes.

Photochemistry- comparison between thermal and photochemical reactions, Beer-Lambert's law, Grotthus-Drapper's law, Einstein's law, quantum yield. Phosphorescence, fluorescence, chemiluminescence and photosensitization - definitions with examples.



**UNIT V****(12 hrs)****Solutions and Solid State**

Solution- types and examples of solutions - liquid in liquid, Raoult's laws, deviation from ideal behavior, vapour- pressure curve for a totally miscible binary liquid systems obeying Raoult's law, partially miscible liquid system (phenol-water system)

Solid state- typical crystal lattices - unit cell, elements of symmetry, Bragg's equation, Weiss Indices, Miller indices, simple body centered and face centered lattices

**Text Books**

S.No	Authors	Title of the Book	Publishers	Year of Publication
1.	Dr. Veeraiyan V	Text book of Allied Chemistry	High mount Publishing House, Chennai-14	Reprint 2006
2.	B.R.Puri, L.R.Sharma, L.S.Pathania	Principles of Physical chemistry	Vishal Publishing Co, Jalandhar, New Delhi	Reprint 2013
3.	Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan	Advanced Inorganic Chemistry – Vol. I	S.Chand & Co. Ltd.	Reprint 2012

**Pedagogy**

Lecture by chalk and talk, power point presentation, e-content, numerical exercise, group discussion, assignment, quiz, peer learning, seminar

**Course Designers:**

Dr.Sowmya Ramkumar

Dr.S.Charulatha

**Question Paper Pattern****End Semester Examination**

BLOOM'S CATEGORY	SECTION	WORD LIMIT	MARKS	TOTAL
K1, K2	A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	100
K1, K2	B -5 x 6 Marks ( Either/or)	300	30	
K3, K4	C – 5x 12Marks ( Either/or)	600-800	60	

COURSE NUMBER	COURSE NAME	Category	L	T	P	Credit	Category
CE22C02	GENERAL CHEMISTRY PAPER - II	Theory	71	4	-	5	Theory

### Preamble

To enable the students to

- escalate the variations in atomic and physical properties of the s & p-block elements
- recognize the relationships between constitutional (structural) isomers, conformational isomers, and geometric isomers
- understand the terminology, factors, similarities and differences of nucleophilic substitution reactions and elimination reactions
- gain knowledge on the types and properties of colloids and liquid crystals
- learn the concepts of 2<sup>nd</sup> law of thermodynamics
- 

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	understand the basics of s & p-block elements, isomerism of organic compounds, halides, colloids and thermodynamics	K <sub>1</sub>
CLO2	infer the general trends of s & p-block elements, stereochemistry of organic compounds, mechanism of organic reactions and explain the significance of colloids/thermodynamics	K <sub>2</sub>
CLO3	Examine the uses of s & p-block compounds, various types of stereoisomerism, reactivity of alkyl/aryl halides, types of colloids and conditions of equilibrium and spontaneity	K <sub>3</sub>
CLO4	Analyze the properties of s & p-block elements, the configuration and conformations of organic compounds, halides, colloids and thermodynamic functions	K <sub>4</sub>

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	M	H	H
CLO2	H	H	M	H	H
CLO3	H	H	M	H	H
CLO4	H	H	M	H	H

H-High; M-Medium; L-Low

**Unit I****(14 hrs)**

**S-block elements** : General characteristics, physical and chemical properties and uses, Compounds of s-block elements- oxides, hydroxides, peroxides, super oxides- preparation and properties-oxo salts-carbonates-bicarbonates-nitrates-halides and poly halides. Diagonal relationships, salient features of hydrides, solvation and complexation tendencies.

**P-block elements** : Comparative study (including diagonal relationship) of group 13 to 17 elements, compounds like hydrides, oxides, carbides and halides group 13 to 16. Hydrides of boron – diboranes and its structure. Basic properties of halogens, interhalogens and poly halides.

Concepts of virtual lab: flame test for s,p elements

**Unit –II****(14 hrs)****Stereochemistry of organic compounds**

Concepts of isomerism, types of isomerism. Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism – conformational analysis of ethane and n-butane: conformations of cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

**Unit–III****(14 hrs)****Alkyl and Aryl Halides**

**Alkyl Halides** – Types of Nucleophilic Substitution ( $SN^1$ ,  $SN^2$  and  $SN^i$ ) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

**Aryl Halides** – Preparation: (Chloro, bromo and iodo-benzene) from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism:  $KNH_2/NH_3$  (or  $NaNH_2/NH_3$ ). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

**UNIT IV****(14 hrs)**

## Colloidal State

Definition of colloids, Classification of Colloids, Solids in Liquids (SOLS): Properties-kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number.

Liquids in Liquids (emulsions): types of emulsions, preparation, emulsifier. Liquids in Solids(Gels):

Classification, preparation and properties, inhibition, general applications of colloids

Liquid Crystals: difference between liquid crystal, solid and liquid. Classification, structure of nematic and Cholestric phases. Thermography and seven segment cell.

## UNIT V

(15 hrs)

### Thermodynamics –II

Second law of thermodynamics – Need for second law, different statements, entropy-definition, physical significance, entropy of an ideal gas, entropy changes in isothermal transformation, entropy changes in reversible and irreversible processes. Trouton's rule. Entropy as a function of T and V, entropy as a function of T and P. Entropy of mixing of ideal gas. General conditions of equilibrium and spontaneity- Conditions of equilibrium and spontaneity under constraints, definition of A and G, physical significance of A and G. Maxwells relations. Temperature and pressure dependence of G, Gibbs – Helmholtz equation.

### Text Books

S. No	Author	Title of the Book	Publishers	Year of Publication
1	ArunBahl B. S. Bahl	A Text Book of Organic Chemistry	S. Chand Sons Company Pvt Ltd	2016
2	P. L. Soni	Text Book of inorganic Chemistry	Sultan Chand and Sons	2013
3	B. R. Puri, L. R. Sharma, M. S. Patania	Principles of Physical Chemistry	Vishal Publishing & Co	2017
4	D. Nasipuri	Stereochemistry of Organic Compounds	New Age International Ltd	2004

### Reference Books

S. No	Author	Title of the Book	Publishers	Year of Publication
1	ArunBahl B. S. Bahl	Advanced Organic Chemistry	S. Chand Sons Company Pvt Ltd,	2009
2	Jagdamba Singh, L. D. S. Yadhav	Advanced Organic Chemistry	PragathiPrakahasan	2013
3	J.D Lee	Concise Inorganic Chemistry	English Language Book Society	2008
4	James E Huheey	Inorganic Chemistry	Pearson India Education Services	2015
5	R. T. Morrison and R.	Organic Chemistry	Pearson India	2010

	N. Boyd		Education Services	
6	K. S. Tewari, N. K. Vishnoi	A Textbook of Organic Chemistry	Vikas Publishing House	2017
7	P. S. Kalsi	Stereochemistry	New Age International	2000
8	B. R. Puri, L. R. Sharma, K. K. Kalia	Principles of Inorganic Chemistry	Milestone Publishers and Distributors	2011
9	R. D. Madan	Modern Inorganic Chemistry	S. Chand Sons Company Pvt Ltd	2014

**Pedagogy:** Lecture by chalk and talk, power point presentation, e-content, Numerical exercise, group discussion, assignment, quiz, peer learning, seminar

**Course Designers**

1. Dr. N. Shyamaladevi
2. Dr. S. Jone Kirubavathy

**Question Paper Pattern**

**End Semester Examination**

BLOOM'S CATEGORY	SECTION	WORD LIMIT	MARKS	TOTAL
K1, K2	A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	100
K1, K2	B -5 x 6 Marks ( Either/or)	300	30	
K3, K4	C – 5x 12Marks ( Either/or)	600-800	60	

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
CE22A02	IDC – CHEMISTRY FOR BIOLOGISTS - II (Offered to B.Sc Botany/Zoology/Biotechnology)	THEORY	71	4	-	5

### Preamble

To enable the students to

- learn the nomenclature, applications of coordination compounds and their significance in bioinorganic chemistry
- analyze the chemistry behind fuels, fertilizers and polymers.
- gain knowledge about the functions of various drugs and important terms in the chemistry of dyes.
- understand the basic concepts of chemical kinetics and catalysis.
- familiarize the importance of pH and Buffer

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	recall the nomenclature of coordination compounds, types of fuel gases, polymers, synthetic drugs, dyes, catalysis and buffer	K1
CLO2	compare various theories to explain the formation of coordination compounds, uses of different fuels, polymers and drugs. Recognize the theories of kinetics and significance of pH / buffer	K2
CLO3	examine the applications of chelating compounds, polymers, dyes and catalytic enzymes. Calculate the degree of hydrolysis using various methods	K3
CLO4	Appraise the importance of inorganic metal, inorganic polymers, pH and buffer in the living system. Categorize polymer, drugs based on mode of action and analyze the mechanism of catalytic action	K4

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	M	H	H
CLO2	H	H	M	H	H
CLO3	H	H	H	H	H
CLO4	H	H	H	H	H
CLO5	H	H	H	H	H

H- High; M-Medium; L-Low

## **IDC – CHEMISTRY FOR BIOLOGISTS - II(CE22A02)**

**(Offered to B.Sc Botany/Zoology/Biotechnology) (71 hrs)**

### **Unit I (15hrs)**

#### **Coordination and Bioinorganic Chemistry**

Nomenclature - mononuclear complexes. Theories- Werner, Sedgwick-EAN rule, Pauling's theory - postulates and examples. Applications of coordination compounds - in qualitative and quantitative analysis. Chelation and its industrial importance with reference to EDTA in analytical chemistry. Structural features and biological functions of Chlorophyll, Hemoglobin, Rubredoxin and Ferredoxin.

### **Unit II (14hrs)**

#### **Industrial Chemistry**

**Fuel gases** - Natural gas, water gas, semi water gas, carbureted water gas, producer gas and oil gas (manufacturing details not needed) composition and uses only.

**Fertilizers**-Primary and secondary nutrients, need and requirements of fertilizers - preparation, properties and uses of urea, super phosphate of lime, ammonium sulphate, triple super phosphate and potassium nitrate. Pesticides - classification with examples.

**Polymers** – Classification -preparation and uses of PVC, Teflon & Polyethylene. Inorganic polymers - synthesis, properties and uses of silicones.

### **Unit III (14hrs)**

#### **Synthetic drugs and Synthetic dyes**

**Synthetic drugs** -Introduction, classification - based on chemical structure and therapeutic action and requirements of a drug. Sulpha drugs and mode of action. Hypnotics, sedatives, anticonvulsants, antidepressants, antipyretics, anaesthetics, antihistamines, anticoagulant, analgesics, diuretics, antimalarial, antifungal, antibacterial, antitubercular and antileprosy - definition, examples and side effects.

**Synthetic dyes** - Introduction, chromophore, auxochrome, chromogen, bathochromic, hypsochromic, hyperchromic and hypochromic shifts. Azo dyes, vat dyes, mordant dyes. Food colours- general treatment.

### **Unit IV (14hrs)**

#### **Chemical Kinetics and Catalysis**

**Chemical Kinetics** - Definition - order and molecularity - rate of reaction—expression for first, second and third order reactions( derivation not required only equation).Effect of temperature on reaction rate – Arrhenius equation – concept of activation energy -collision theory (elementary treatment only) - failures of collision theory.

**Catalysis** - types, mechanism of catalytic action - homogeneous, heterogeneous and enzyme catalysis, industrial applications of enzymes.

### Unit V

(14hrs)

#### Importance of pH and Buffer

pH, pH scale, buffer solutions - types - buffer mixture of weak acid and its salt - buffer mixture of weak base and its salt. Importance of pH and buffer in the living system.

Hydrolysis of salts – types (strong acid vs strong base, weak acid vs strong base, strong acid vs weak base, weak acid vs weak base)- hydrolysis constant ( $K_h$ ) - relation between  $K_h$ ,  $K_a$  and  $K_w$ - degree of hydrolysis and determination - indirect method, electrical conductance method (Bredig's method), freezing point depression and from distribution law.

#### Text Books:

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1.	Dr. V.Veeraiyan	Text book of Allied Chemistry	2 <sup>nd</sup> Edn, High mount Publishing house, triplicane, Chennai.	Reprint 2005
2.	B.S.Bahl, ArunBahl and G.D.Tuli	Essentials of Physical Chemistry	S Chand & Company Ltd, New Delhi.	Reprint 2000
3.	B.K.Sharma	Industrial Chemistry	GOEL Publishing House	Reprint 2000

#### Pedagogy:

Lecture by chalk and talk, power point presentation, e-content, numerical exercise, group discussion, assignment, quiz, peer learning, seminar

#### Course Designers

1. Dr.R.Revathi
2. Dr.N.Anusuya

#### Question Paper Pattern

##### End Semester Examination

BLOOM'S CATEGORY	SECTION	WORD LIMIT	MARKS	TOTAL
K1, K2	A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	100
K1, K2	B -5 x 6 Marks ( Either/or)	300	30	
K3, K4	C – 5x 12Marks ( Either/or)	600-800	60	



COURSE NUMBER	COURSE NAME	Category	L	T	P	Credit
CE22A04	IDC – ALLIED CHEMISTRY PAPER –II (For B.Sc Physics)	Theory	71	4	-	4

### Preamble

To enable the students to

- understand the concepts of aromaticity, isomerisms and nuclear chemistry
- understand the concepts of electrochemistry
- gain knowledge about the basics of surface chemistry
- know the basics of fuels, polymers and water treatment methods

### Course Outcomes

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

CLO Number	CO Statement	Knowledge Level
CLO1	recall the fundamental subatomic particles, criteria for aromaticity, terms in electrochemistry, mole concept, chemistry of fuels, polymers	K <sub>1</sub>
CLO2	relate the stability of a nucleus, property of different structural and stereo isomers, theories of electrochemistry on conductance measurements, importance of pH and buffers in the living systems, ions responsible for temporary and permanent hardness of water	K <sub>2</sub>
CLO3	apply the laws of nuclear chemistry in calculating nuclear binding energy, element of symmetry for predicting the isomers, principles of chromatographic techniques, relate the structure of polymers on its application	K <sub>3</sub>
CLO4	analyse the modes of radioactive decay, conformational analysis of cyclic and acyclic systems, to solve problems related to conductance, categorize the solution based on its pH, techniques for softening of hard water	K <sub>4</sub>

### Mapping with Programme Outcomes

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	M	H	H	M	M	M
CLO2	M	H	H	M	M	M
CLO3	M	H	H	M	M	M
CLO4	M	H	H	M	M	M

H- High; M-Medium; L-Low

## IDC – Allied Chemistry Paper –II (For B.Sc Physics) CE22A04 (71Hrs)

### UNIT I

(14 Hrs)

#### Nuclear Chemistry

Fundamental particles of nucleus, isobars, isotones and isomers, differences between chemical reactions and nuclear reaction, fusion and fission, mass defect, derivation of  $1\text{amu} = 931\text{ MeV}$ - nuclear binding energy and calculation - packing fraction, n/p ratio, magic numbers-radioactive series-  $4n+1$ ,  $4n+2$ ,  $4n+3$ , group displacement law- modes of radioactive decay- half-life period- applications of radio isotopes- carbon dating and rock dating.

### UNIT II

(14Hrs)

#### Organic Chemistry

Aromatic compounds- aromaticity, Huckel's rule, aromatic electrophilic substitution, mechanism of nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation.

Isomerisms- optical isomerism, elements of symmetry, polarized light and optical activity, isomerism of lactic acid and tartaric acid, racemisation and resolution, Geometrical isomerism- cis-trans isomerism, keto-enol tautomerism, conformational analysis of ethane, n-butane and cyclohexane.

### UNIT III

(14Hrs)

#### Electrochemistry

Electronic and electrolytic conductors, Arrhenius theory of electrolytic dissociation. Conductance-specific & equivalent conductance and their determination, variation of conductance with dilution, Ostwald's dilution law. Kohlrausch's law & application - determination of degree of dissociation of weak electrolytes, conductometric titrations.

Faraday's law of electrolysis, Galvanic cells:EMF and its origin, standard electrode potentials, electrochemical series and its applications, formation of standard cells, cell reaction and calculation of EMFs,  $\Delta G$  and spontaneity of a reaction.

### UNIT IV

(14Hrs)

**Solution**- mole concept, mole fraction, molality, molarity, normality. Primary and secondary standards-preparation of standard solutions, principle of volumetric analysis (with simple problems), acid-base of redox titration.

**Ionic product of water**-pH, pKa, pKb - definition, determination of pH by indicator method. **Buffer solutions**- types, buffer action, pH of buffer solutions, importance of pH and buffers in the living systems.

**Surface chemistry**- emulsions, gels- preparation, properties and applications,

**Chromatography** – basic principles of column, paper and thin layer chromatography.

**UNIT V**

**(15Hrs)**

**Industrial Chemistry**

Fuels- classification-gaseous fuels like water gas, producer gas, liquefied petroleum gas, go bar gas, compressed natural gas

Polymers- classifications, preparation and uses of PVC, Teflon & Polyethylene, bakelite, synthesis, properties and uses of silicones.

Hardness of water- temporary and permanent hardness, disadvantages of hard water -softening of hard water - Zeolite process, demineralization process and reverse osmosis - purification of water for domestic use: use of chlorine, ozone and UV light.

**Text Books**

S.No	Authors	Title of the Book	Publishers	Year of Publication
1.	H.J.Arniker	Essentials of Nuclear Chemistry	New Age International Pvt., Ltd., Publishers	2011 4 <sup>th</sup> Edn
2.	Dr. Veeraiyan V	Text book of Allied Chemistry	Highmount Publishing House, Chennai-14	Reprint 2006
3.	B.R.Puri, L.R.Sharma, L.S.Pathania	Principles of Physical chemistry	Vishal Publishing Co, Jalandhar, New Delhi	Reprint 2013

**Pedagogy**

Lecture by chalk and talk, power point presentation, e-content, numerical exercise, group discussion, assignment, quiz, peer learning, seminar

**Question Paper Pattern**

**End Semester Examination**

BLOOM'S CATEGORY	SECTION	WORD LIMIT	MARKS	TOTAL
K1, K2	A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	100
K1, K2	B -5 x 6 Marks ( Either/or)	300	30	
K3, K4	C – 5x 12Marks ( Either/or)	600-800	60	

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
CE21CP1	CHEMISTRY PRACTICAL - I	THEORY	86	4	-	5

### Preamble

To enable the students to

- learn the theoretical basis of qualitative inorganic analysis containing simple and interfering radicals and analyze a mixture containing two anions, one of which is interfering and two cations.
- Learn the quantitative estimations and calculation of pH

### Course Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	identify, separate the cations into groups and report the acid and basic radicals	K <sub>1</sub> , K <sub>2</sub>
CLO2	estimate the percentage amount of chlorine, carbonates, Mg, Na in bleaching powder, hard water, detergent	K <sub>4</sub>
CLO3	estimate the percentage amount of chlorine, carbonates, Mg, Na in bleaching powder, hard water, detergent	K <sub>4</sub>

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	H	H	H
CLO2	H	H	H	H	H
CLO3	H	H	H	H	H

H-High; M-Medium; L-Low

**Chemistry Practical – I (CE21CP1)****(90 Hrs)****Credits: 4**

1. Analysis of mixture containing two anions one of which is interfering in nature and two cations:  
The following cations and anions may be given  
Anions :  $\text{Cl}^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{Br}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{F}^-$ ,  $\text{BO}_3^{2-}$ ,  $\text{C}_2\text{O}_4^{2-}$ ,  $\text{CrO}_3^{2-}$ ,  $\text{PO}_4^{3-}$   
Cations :  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{NH}_4^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Sr}^{2+}$

**GROUP EXPERIMENTS:**

2. (i) Estimation of available chlorine in bleaching powder  
(ii) Estimation of hardness of water
3. pH Measurements  
(i) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps using pH meter (Note: Use dilute solutions of soaps and shampoos)  
(ii) Preparation of buffer solutions  
a. Sodium acetate-acetic acid  
b. Ammonium chloride-Ammonium hydroxide

**Text Book**

Lab Manual - Prepared by Faculty, Department of Chemistry, PSGRKCW

**Reference book:**

S.No	Authors	Title of the Book	Publishers	Year of Publication
1	V. V. Ramanujam	Inorganic semi micro qualitative analysis,	The National Publishing Co.	Revised 3 <sup>rd</sup> Edn., 1974
2	Jain P. C and Jain M	Engineering Chemistry	Dhanpat Rai and Sons	16 <sup>th</sup> edition, 2013
3	Vogel A. I	Text Book of Practical Organic Chemistry	Prentice Hall	2011, 5 <sup>th</sup> edition
4	Khosla B D, Garg V C, Gulati A	Senior Practical Physical Chemistry	R Chand & Co	2011

**Pedagogy:**

Demonstration and individual hands on practical's

**Course Designers**

1. Dr. N. Shyamaladevi  
2. Dr. S. Jone Kirubavathy

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
CE21AP1	<b>IDC –CHEMISTRY PRACTICAL FOR BIOLOGISTS</b> (offered to B.Sc Botany / Zoology/Biotechnology)	PRACTICAL	-	-	90	2

### Preamble

To enable the students to

- estimate the given substance volumetrically.
- analyse and identify the organic compounds qualitatively

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	define the various terms in volumetric analysis	K <sub>1</sub>
CLO2	perform the volumetric analysis and estimate the quantity present.	K <sub>2</sub> , K <sub>3</sub>
CLO3	identify and analyse organic compounds	K <sub>3</sub>

### Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	H	H	H
CLO2	H	H	H	H	H
CLO3	H	H	H	H	H

H - High; M-Medium; L-Low

## IDC –CHEMISTRY PRACTICAL FOR BIOLOGISTS (CE21AP1)

(offered to B.Sc Botany /Zoology/Biotechnology)

(90hrs)

### 1. Volumetric Analysis

- i. Estimation of sodium hydroxide using standard sodium carbonate.
- ii. Estimation of Carbonate, bicarbonate mixture using sodium hydroxide
- iii. Estimation of hydrochloric acid using standard oxalic acid.
- iv. Estimation of oxalic acid using standard sulphuric acid.
- v. Estimation of ferrous sulphate using standard Mohr's salt solution.
- vi. Estimation of potassium permanganate using standard oxalic acid.
- vii. Estimation of hardness of water (Temporary and permanent).

### 2. Organic Compound Analysis

Systematic analysis of organic compounds containing one functional group and characterization by confirmatory tests and preparing suitable derivative - Phenols, Acids (mono and di), Aromatic primary amine, Amides (mono and diamide) and Glucose.

#### Text Book:

Lab Manual- Prepared by Faculty, Department of Chemistry, PSGRKCW

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	N.S.Gnanapragasam, G.Ramamurthy	Organic Chemistry Lab Manual	S.Viswanathan Printers & Publishers Pvt Ltd	3 <sup>rd</sup> Edn.,2011
2	A.I. Vogel	A text book of quantitative inorganic analysis	Longman publishers	12 <sup>th</sup> Edn., 2011

#### Pedagogy

Demonstration and individual hands on Practicals.

#### Course Designers:

Dr.R.Revathi

Dr.N.Anusuya

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
CE21AP2	<b>IDC – ALLIED CHEMISTRY PRACTICAL</b> (offered for B.Sc Physics)	PRACTICAL	-	-	90	2

### Preamble

To enable the students to

- estimate the given substance volumetrically
- understand the principle and carry out potentiometric / conductometric titrations

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	define the various terms in volumetric analysis	K <sub>1</sub>
CLO2	perform the volumetric analysis and estimate the quantity present.	K <sub>2</sub> , K <sub>3</sub>
CLO3	Calculate the hardness of water samples	K <sub>4</sub>
CLO4	recall the various terms in conductometric and potentiometric experiments	K <sub>1</sub>

### Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	H	H	H
CLO2	H	H	H	H	H
CLO3	H	H	H	H	H
CLO4	H	H	H	H	H

H - High; M-Medium; L-Low



## IDC – ALLIED CHEMISTRY PRACTICAL (CE21AP2) (90hrs)

(offered for B.Sc Physics)

### 1. Volumetric Analysis

- i. Estimation of sodium hydroxide using standard sodium carbonate.
- ii. Estimation of carbonate, bicarbonate mixture using sodium hydroxide
- iii. Estimation of hydrochloric acid using standard oxalic acid.
- iv. Estimation of oxalic acid using standard sulphuric acid.
- v. Estimation of ferrous sulphate using standard Mohr's salt solution.
- vi. Estimation of potassium permanganate using standard oxalic acid.
- vii. Estimation of hardness of water (temporary and permanent).

### 2. Conductivity Experiments

1. Determination of cell constant
2. Determination of dissociation constant of a weak acid.
3. Conductometric titration: Acid – base

### 3. Potentiometric Titration

1. Acid - base
2. Redox titration

**Text Book :** Lab Manual- prepared by faculty, Department of Chemistry, PSGR Krishnammal College for Women, Coimbatore

### Reference Books

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	V.Venkateswaran, R. Veeraswamy & A.R. Kulandaivelu	Basic Principles of Practical Chemistry	S.Chand & Co.	2012 Reprint 2 <sup>nd</sup> Edn.
2	B. Vishwanathan, P.S. Raghavan	Practical Physical Chemistry	Viva Books	2014 Reprint

### Pedagogy

Demonstration and individual hands on Practicals

### Course Designers

Dr.Sowmya Ramkumar

Dr.S.Charulatha

**SEMESTER – I - FOUNDATION COURSE**

**INTRODUCTION TO ENTREPRENEURSHIP**

**SUBJECT CODE: NME21ES**

**CREDITS : 2**

**TOTAL HOURS : 30**

**LECTURE HOURS : 26**

**TUTORIAL HOURS : 4**

**Unit 1: (5 hrs)**

**Nature of Entrepreneurship: (3 hrs)**

Meaning –Need for Entrepreneurship –Qualities of Successful Entrepreneurs - Myths of Entrepreneurship

**Activity:** Assignment, Discussion (2 hrs)

**Unit 2: (6 hrs)**

**Role of Entrepreneurs (4 hrs)**

Significance of Entrepreneurship to the nation –Environmental Factors influencing Entrepreneurship –  
Entrepreneurial Process and Functions- Challenges faced by Entrepreneurs

**Activity:** Quiz / Role Play (2 hrs)

**Unit 3: (6 hrs)**

**Formulation of Business Idea: (4 hrs)**

Business Idea Generation - Entrepreneurial Imagination and Creativity – Role of Innovation – Opportunity  
Evaluation

**Activity:** Business Idea Pitch (2 hrs)

**Unit 4: (6 hrs)**

**Business Planning: (4 hrs)**

Need for Market Study – Securing Finance from various Sources - Significance of Business plan – Components  
of Business plan

**Activity:** Schemes available for Entrepreneurs (2 hrs)

**Unit 5: (7 hrs) (7 hrs)**

**Project:**

**Interface with Successful Entrepreneurs** – 4hrs

**Business Plan Presentation** – 3hrs

### **Reference Books**

1. D.F. Kuratko and T.V. Rao, *Entrepreneurship - South Asian Perspective*, 2016, Cengage Learning India Pvt. Ltd. Delhi.
2. Arya Kumar, *Entrepreneurship: Creating and Leading an Entrepreneurial Organization*, 2012, Pearson Education India

### **Internal Pattern**

**CIA I and II –50 Marks (2 hrs) Each- 100 marks - Converted into 60 Marks**

**Activity (Quiz-5, Assignment-5, Schemes for Entrepreneurs - 5, Idea Pitch -5) - 20 Marks**

**Project (Business Plan Presentation) - - 20 Marks**

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**Total - 100 Marks**

### **Question paper pattern for CIA-**

**Section-A (Paragraph answers-4 out of 6) 4x5 = 20marks**

**Section-B (Essay type-2 out of 3) 2x15 = 30marks**

**Total = 50 marks**

**Portions:**

**CIA-1 – Unit-1 and 2**

**CIA-II- Unit- 3 and 4**

<b>COURSE NUMBER</b> 21PEPS1	<b>COURSENAME</b> <b>I BSc Physics, Chemistry, Mathematics</b> <b>SEMESTER- II</b> <b>PROFESSIONAL ENGLISH FOR</b> <b>PHYSICAL SCIENCES</b>	Category	L	T	P	Credit
			40	5		2

### Objectives

1. To develop the language skills of students by offering adequate practice in professional contexts.
2. To enhance the lexical, grammatical and socio-linguistic and communicative competence of first year physical sciences students
3. To focus on developing students' knowledge of domain specific registers and the required language skills.
4. To develop strategic competence that will help in efficient communication
5. To sharpen students' critical thinking skills and make students culturally aware of the target situation.

### Course Outcomes

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

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	recognise their own ability to improve their own competence in using the language	K1
CLO2	use language for speaking with confidence in an intelligible and acceptable manner	K2
CLO3	read independently unfamiliar texts with comprehension and understand the importance of reading for life	K3
CLO4	understand the importance of writing in academic life	K3
CLO5	write simple sentences without committing error of spelling or grammar	K3

(Outcomes based on guidelines in UGC LOCF – Generic Elective)

## PROFESSIONAL ENGLISH FOR PHYSICAL SCIENCES - 21PEPS1

### UNIT 1: COMMUNICATION

8 hours

**Listening:** Listening to audio text and answering question  
Listening to Instructions

**Speaking:** Pair work and small group work.

**Reading:** Comprehension passages –Differentiate between facts and opinion

**Writing:** Developing a story with pictures.

**Vocabulary:** Register specific - Incorporated into the LSRW tasks

### UNIT 2: DESCRIPTION

8 hours

**Listening:** Listening to process description.-Drawing a flow chart.

**Speaking:** Role play (formal context)

**Reading:** Skimming/Scanning- Reading passages on products, equipment and gadgets.

**Writing:** Process Description –Compare and Contrast Paragraph-Sentence Definition and Extended definition- Free Writing.

**Vocabulary:** Register specific -Incorporated into the LSRW tasks.

### UNIT 3: NEGOTIATION STRATEGIES

8 hours

**Listening:** Listening to interviews of specialists / Inventors in fields (Subject specific)

**Speaking:** Brainstorming. (Mind mapping).

Small group discussions (Subject- Specific)

**Reading:** Longer Reading text.

**Writing:** Essay writing (250 words)

**Vocabulary:** Register specific - Incorporated into the LSRW tasks

### UNIT 4: PRESENTATION SKILLS

8 hours

**Listening:** Listening to lectures.

**Speaking:** Short talks.

**Reading:** Reading Comprehension passages

**Writing:** Writing Recommendations Interpreting Visual inputs

**Vocabulary:** Register specific - Incorporated into the LSRW tasks

## UNIT 5: CRITICAL THINKING SKILLS

**8 hours**

**Listening:** Listening comprehension- Listening for information.

**Speaking:** Making presentations (with PPT- practice).

**Reading :** Comprehension passages –Note making.

Comprehension: Motivational article on Professional Competence, Professional Ethics and Life Skills)

**Writing:** Problem and Solution essay– Creative writing –Summary writing

**Vocabulary:** Register specific - Incorporated into the LSRW tasks

### Text Books

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	TamilNadu State Council for Higher Education (TANSICHE)	English for Physical Sciences Semester 1	--	--

### Refence Books

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	Sreedharan, Josh	The Four Skills for Communication	Foundation books	2016
2	Pillai, G Radhakrishna, K Rajeevan, P Bhaskaran Nair	Spoken English for you	Emerald	1998
3	Pillai, G radhakrishna, K Rajeevan, P Bhaskaran Nair	Written English for you	Emerald	1998

**Evaluation pattern:** Internal 50 marks  
ESE 50 marks

#### NOTE 1 :

Internals 5 tests x 10 marks each=50 marks

Test 1 : Listening  
Test 2 : Speaking  
Test 3 : Reading  
Test 4 : Listening  
Test 5 : Speaking

**ESE : Only Reading, Writing and Vocabulary components from all 5 units**

**Question Paper pattern for ESE**

Section A :  $5 \times 2 = 10$  marks

Section B :  $4/6 \times 5 = 20$  marks

Section C :  $2/3 \times 10 = 20$  marks

**Total = 50 Marks**

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
CE22C03	GENERAL CHEMISTRY PAPER - III	Theory	58	2	-	4

### Preamble

To enable the students to

- gain knowledge about the characteristics and metallurgy of d-block elements.
- understand the chemistry of interhalogens compounds.
- learn the concepts of acids and bases.
- familiarize the organic reactions of aldehydes, ketones, Carboxylic acids and esters.
- acquire insight into phase rule and its applications.

### Course Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	describe the extraction and refining methods of metals, examine the concepts of acids and bases, recognize the naming reaction and purification techniques	K1
CLO2	compare the properties of d-block elements, predict the mechanism of oxidation/condensation reactions, identify the ideal & non-ideal solutions	K2
CLO3	illustrate the chemistry of interhalogen compounds, interpret the hardness, softness and properties of dicarboxylic acid, sketch the phase diagram for one/two component system	K3
CLO4	analyze the metallurgy of d block elements, examine the synthesis of aldehydes, ketones, and hydroxy acids	K4

### Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	H	H	H	M
CLO2	H	H	H	H	H	M
CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	H	H

H - High; M-Medium; L-Low



**Unit–I**

(11 hrs)

**D-block elements**

Introduction, position, general characteristics-metallic character, atomic volume and densities, melting point and boiling point, atomic radii, ionic radii, ionization potential, standard reduction potential, magnetic property, catalytic property and formation of alloys. Horizontal comparison of Fe, Co, Ni and Zn, Cd and Hg groups.

Metallurgy, properties and uses of Ti, V, Mo and W.

Inter halogen compounds - ICl, ClF<sub>3</sub>, BrF<sub>5</sub>, IF<sub>7</sub> - Preparation, properties, structure and uses.

**Unit–II**

(11 hrs)

**Acids and Bases**

Definitions, different approaches - Arrhenius concept, Bronsted-Lowry concept, solvent system definition, Lewis definition. Relative strength of acids and bases. Acidity and basicity of solvolytic reaction. HSAB - Principle. Application & limitations of HSAB concept. Symbiosis, theoretical basis of hardness and softness. Electronegativity, hardness and softness.  $\pi$ -bonding contributions.

**Non aqueous Solvents**

Classification-protic and aprotic solvents, liquid ammonia (acid-base, precipitation, complex formation, ammonolysis and solvolysis reactions) and liquid sulphur dioxide (acid-base, solvolytic, metathetical, complex formation and amphoteric reactions).

**Unit–III**

(12 hrs)

**Carbonyl Compounds**

Nomenclature, classification and reactivity, general methods of preparation of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group - addition of HCN, alcohols, thiols, sodium bisulfite, Grignard reagents. Oxidation reactions - Tollens' reagent, KMnO<sub>4</sub>, hypochlorite, SeO<sub>2</sub> and per acids. Reduction reactions - H<sub>2</sub>/Ni, H<sub>2</sub>-Pd-C, NaBH<sub>4</sub>, LiAlH<sub>4</sub>, MPV,

Clemmensen and Wolff-Kishner reductions. Condensation reactions with ammonia and its derivatives- Aldol, Perkin, Knoevenagel, Reformatsky and Cannizaro reactions.

#### **Unit–IV**

**(12 hrs)**

#### **Carboxylic acids and their functional derivatives**

Nomenclature and classification of aliphatic and aromatic carboxylic acids. Preparation, properties and uses of Dicarboxylic acids (Oxalic, Malonic, Glutaric, Adipic acid) and unsaturated acids (Acrylic acid and Crotonic acid).

#### **Hydroxy acids - Preparation, properties and uses of Tartaric acid and Citric acid.**

**Esters** - Nomenclature, Isomerism, General methods of preparation - Esterification, alcoholysis of acid chlorides and acid anhydrides, silver salt method, Tischenko reaction. Properties and uses. Active methylene compounds - acetoacetic ester, and malonic ester- preparation, properties and uses.

#### **Unit–V**

**(12 hrs)**

#### **Solutions of Non electrolytes**

Ideal and non-ideal solutions - Raoult's law, vapour pressure of non-ideal solutions, fractional distillation of binary liquid solutions, distillation of immiscible liquids, Nernst distribution law and its applications. Azeotropic distillation, solubility of partially miscible liquids - Phenol - water system, Nicotine-water system and triethylamine- water system.

#### **Phase Equilibria**

Concepts of phase, component and degrees of freedom. Gibbs' phase rule – derivation. One component system - Water and sulphur. Two component system-Simple eutectic: Lead-silver system, Formation of compound with congruent melting point- Mg-Zn system, incongruent melting point - Ferric chloride – water system.

**Text Books:**

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	B.S. Bahl & Arun Bahl	Organic Chemistry	S.Chand & Co, 15th Edn	2009
2	R. D Madan	Modern Inorganic Chemistry	S. Chand & Co, 3rd Edn	2011
3	B.R. Puri, L.R. Sharma, M.S. Pathania	Principles of Physical Chemistry	Vishal Publications, 45th Edn	2011

**Reference Books:**

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	B.S. Bahl & Arun Bahl	Essentials of Physical Chemistry	S. Chand & Co, 22nd Edn	2014
2	R.T. Morrison & R.W. Boyd	Organic Chemistry	Pearson Prentice Hall, 17th Edn	2011
3	A. Peter Sykes	A Guide book to Mechanism in Organic Chemistry	Pearson Education Ltd, 6th Edn	2009

**Pedagogy:** Lecture by chalk and talk, power point presentation, e-content, group discussion, assignment, quiz, peer learning, student seminar, problem solving exercise

**Portion marked in Bold – Blended Learning**

**Course Designers:**

1. Dr. N.Arunadevi
2. Dr. G.Subashini

**End Semester Examination: 100 Marks**

SECTION	WORD LIMIT	MARKS	TOTAL
A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	100
B - 5 x 6 Marks ( Internal Choice at same CLO Level)	300	30	
C – 5x 12Marks ( Internal Choice at same CLO Level)	600-800	60	

### Blended Learning

UNITS	Topic	Contents
I	Preparation, properties, structure and uses - ICl, ClF <sub>3</sub>	<a href="https://youtu.be/-Bcur3XLDQU">https://youtu.be/-Bcur3XLDQU</a>
	Preparation, properties, structure and uses - BrF <sub>5</sub> , IF <sub>7</sub>	<a href="https://www.youtube.com/watch?v=C19ey2rpIco">https://www.youtube.com/watch?v=C19ey2rpIco</a>
II	Electronegativity, hardness and softness	<a href="https://www.youtube.com/watch?v=75GXQCq_r1A">https://www.youtube.com/watch?v=75GXQCq_r1A</a>
	□-bonding contributions	<a href="https://www.youtube.com/watch?v=Kju_gywulWM">https://www.youtube.com/watch?v=Kju_gywulWM</a>
III	Aldol, Perkin, Knoevenagel, Reformatsky and Cannizaro reactions.	<a href="https://youtu.be/a0e6Pq64yMY">https://youtu.be/a0e6Pq64yMY</a> <a href="https://youtu.be/a0e6Pq64yMY">https://youtu.be/a0e6Pq64yMY</a> <a href="https://youtu.be/a0e6Pq64yMY">https://youtu.be/a0e6Pq64yMY</a>
IV	Hydroxy acids - Tartaric acid and Citric acid - preparation, properties and uses.	<a href="https://www.youtube.com/watch?v=x23G-JC4jL0">https://www.youtube.com/watch?v=x23G-JC4jL0</a> <a href="https://www.youtube.com/watch?v=UK08PRtK6Qk">https://www.youtube.com/watch?v=UK08PRtK6Qk</a>
	Active methylene compounds – acetoacetic ester, and malonic ester- preparation, properties and uses.	<a href="https://www.youtube.com/watch?v=1ApGSzDdQnM&amp;t=533s">https://www.youtube.com/watch?v=1ApGSzDdQnM&amp;t=533s</a> <a href="https://www.youtube.com/watch?v=W66zGnXvyy4">https://www.youtube.com/watch?v=W66zGnXvyy4</a> <a href="https://www.youtube.com/watch?v=JgmzmehMiWM">https://www.youtube.com/watch?v=JgmzmehMiWM</a>
V	Nicotine-water system – Triethylamine- water system.	<a href="https://www.youtube.com/watch?v=BmURRyJsK9c">https://www.youtube.com/watch?v=BmURRyJsK9c</a> <a href="https://www.youtube.com/watch?v=rZWeTR0JqF4">https://www.youtube.com/watch?v=rZWeTR0JqF4</a>
	Formation of compound with congruent melting point- Mg- Zn	<a href="https://www.youtube.com/watch?v=XTIpebEOQbc">https://www.youtube.com/watch?v=XTIpebEOQbc</a> <a href="https://www.youtube.com/watch?v=wc9g_tchL7c">https://www.youtube.com/watch?v=wc9g_tchL7c</a>
	Incongruent melting point - Ferric chloride – water system.	<a href="https://www.youtube.com/watch?v=S4tQ0Gp6juo">https://www.youtube.com/watch?v=S4tQ0Gp6juo</a> <a href="https://www.youtube.com/watch?v=YyOFH1ZN9Zs">https://www.youtube.com/watch?v=YyOFH1ZN9Zs</a>

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>CATEGORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
<b>CE22CP2</b>	<b>CHEMISTRY PRACTICAL – II</b>	PRACTICAL	-	-	90	5

### **Preamble**

Enable the students to

- identify functional groups in organic compounds
- develop skill in quantitative analysis of solutions volumetrically
- analyze colorants and adulterants in foods and milk/milk products

### **Course Outcomes**

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

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	analyze organic compounds systematically and prepare suitable derivatives	K4
CLO2	calculate the strength of unknown solutions by titrimetric methods	K4
CLO3	identify the various colorants and adulterants in foods and beverages	K3

### **Mapping with Programme Outcomes**

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>	<b>PLO6</b>
CLO1	H	H	H	H	H	M
CLO2	H	H	M	H	H	H
CLO3	H	H	H	H	M	H

H - High; M-Medium; L-Low

**Systematic Analysis - Organic Compounds**

Preliminary tests, detection of elements, nature of the functional group, confirmatory tests and preparation of derivatives – acids, phenols, aldehydes, ketones, amines, amides, carbohydrates, esters and nitro compounds.

**Volumetric Analysis**

**Acidimetry and Alkalimetry**

1. Estimation of sulphuric acid using standard oxalic acid.
2. Estimation of sodium hydroxide using standard sodium carbonate.

**Permanganimetry**

1. Estimation of oxalic acid using standard Mohr's salt solution.
2. Estimation of Mohr's salt solution using standard oxalic acid.

**Dichrometry**

1. Estimation of  $\text{Fe}^{2+}$  ions using internal indicator.
2. Estimation of  $\text{Fe}^{3+}$  ions using internal indicator after reduction.

**Complexometric titrations**

1. Estimation of zinc using EDTA
2. Estimation of magnesium using EDTA

**Iodometry**

1. Estimation of Potassium dichromate.

**Qualitative Analysis of Natural Food Colours (Group Experiments)**

Caramel, Cochineal, Turmeric, Annatto, Chlorophyll and Betanin

**Detection of Adulteration in milk and milk products (Group Experiments)**

Urea, Glucose, Starch, Cellulose, Carbonates & Caustic Soda, Detergent, Salt, Hydrogen Peroxide.

**Text Book:**

Hand Book for Organic Practical's, prepared by Faculty, Department of Chemistry, PSGR Krishnammal College for Women

**Reference Books:**

<b>S.No.</b>	<b>Authors</b>	<b>Title</b>	<b>Publishers</b>	<b>Year of Publication</b>
1.	Brian S Furniss, Antony J Hannaford, Peter.W.G. Smith, Austin R. Tatchell	Vogel's Textbook of Practical Organic Chemistry	Longman Scientific & Technical	1989 5 <sup>th</sup> Edn.
2.	G H Jeffery, J Bassett, J Mendham, R C Denney	Vogel's Textbook of Quantitative Chemical Analysis	Bath Press, Great Britan	1989 5 <sup>th</sup> Edn.
3.	Ministry of Health and Family Welfare Board	Manuals of Methods of Analysis of Foods	Food Safety and Standards - Authority of India, Ministry of Health and Family Welfare, Government of India, New Delhi	2015

**Pedagogy:** Demonstration and individual hands on practical

**Course Designers**

1. Dr. N.Arunadevi
2. Dr. G.Subashini

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>CATEGORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
<b>CE22SB01</b>	<b>Skill Based Subject Computational Chemistry I</b>	<b>THEORY</b>	<b>41</b>	<b>4</b>	<b>-</b>	<b>3</b>

### Preamble

Enable the students to

- understand the basic concepts in computational chemistry & bioinformatics
- appraise the applications of open source tools in chemistry to stimulate molecular structures
- recognize the biological database
- relate the score matrix in sequence alignment

### Course Outcomes

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

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	recall the fundamentals of computers and computational chemistry tools	K1
CLO2	identify the biological databases for various application, the DNA sequencing methods, develop chemical structure representations using open source tools	K2
CLO3	sketch GUI display of chemical structure, perform text and structure based searches, determine the relative score made by matching two characters in a sequence alignment	K3
CLO4	analyse chemical structure representations using open source tools, recognise the challenges and opportunities in bioinformatics	K4

### Mapping with Programme Outcomes

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>	<b>PLO6</b>
CLO1	H	H	H	H	M	H
CLO2	H	H	H	H	M	H
CLO3	H	H	H	H	M	H
CLO4	H	H	H	M	M	H

H - High; M-Medium; L-Low



**Semester III**  
**Skill Based Subject**  
**Computational Chemistry I (CE22SB01)**

**Credits: 2** **(41 hrs)**

**Unit I** **(8 hrs)**

**Fundamentals of Computers in Chemistry**

Introduction to computers- Data and information, Computer system organization, representation of numbers. Computer software's in chemistry- Introduction, Chemical Inventory System (CIS), Material Safety Data Sheet (MSDS), Electronic handbooks, Database.

**Unit II** **(8 hrs)**

**Introduction to Cheminformatics**

Introduction- History & evolution, uses & prospects. Computer representation of chemical structure-graph, theoretical representation of chemical structures, connection tables and linear notations. Structure & substructure searching.

**Unit III** **(8 hrs)**

**Cheminformatics tools**

Chemical structure representation (SMILES and SMARTS); Chemical databases: CSD, ACD, WDI, ChEMBL, PUBCHEM, Chemical structure file formats- SDF, Mol, XYZ, PDB; Structure visualization. Open source tools – Chem office, Chem draw, chem doodle, Chemistry 4D, Computational chemistry software sites.

**Unit IV (8 hrs)**

**Bioinformatics I**

Introduction to Bioinformatics: - History, Scope, importance, challenges and opportunities. Classification of biological databases; sequence database – nucleic acids database (NCBI, DDBJ & EMBL), protein database (PDB, SwissProt), literature database (Pubmed); file formats - GenBank, SwissProt, PDB. Application of bioinformatics in various fields.

**Unit V (9 hrs)**

**Bioinformatics II**

Sequencing Analysis: DNA sequencing - Maxam and Gilbert method, Sanger's method. Protein sequencing scoring Matrices: Similarity searches - PAM and BIOSUM matrix, Dayhoff

mutation matrix, construction of PAM and BLOSUM matrix.

### Textbooks

S.No	Authors	Title of the Book	Publishers	Year of Publication
1	Ramesh Kumari	Computers & their Applications to Chemistry	Narosa Publishing House Pvt Ltd	2007, 2 <sup>nd</sup> Edn
2	KishorArora	Computers Applications in Chemistry	Anmol Publication PvtLtd	2004, 1 <sup>st</sup> Edn
3	Dan E Krane& Michael L Raymer	Fundamental concepts of Bioinformatics	Pearson Education	2003, 1 <sup>st</sup> Edn

### Reference books

S.No	Authors	Title of the Book	Publishers	Year of Publication
1	RajarshaGuha & Andreas Bender	Computational Approaches in Cheminformatics & Bioinformatics	Wiley India Pvt Ltd	2012 1 <sup>st</sup> edition
2	SundarRajan S	Introduction to Bioinformatics	Himalaya Publishing House	2002, 1 <sup>st</sup> Edn

### Pedagogy

Lecture by chalk and talk, power point presentation, e-content, group learning, group discussion, assignment, quiz, peer learning, student seminar, problem solving exercise

### Course Designers

1. Dr. G. Sathya Priyadarshini
2. Dr. Sowmya Ramkumar

**EVALUATION PATTERN - TOTAL: 100 Marks**

TEST I (THEORY/PRACTICAL): 50 Marks

TEST II (THEORY/PRACTICAL): 50 Marks

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
CE22C04	GENERAL CHEMISTRY PAPER - IV	Theory	58	2	-	4

Preamble

To enable the students to

- acquire knowledge about the chemistry of lanthanides and actinides.
- learn the concepts and theories of coordination chemistry.
- familiarize the preparation and properties of nitrogen containing compounds
- understand the basic concepts and theories of chemical kinetics.

Course Outcomes

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

CLO	CLO Statement	Knowledge
CLO1	describe the significance of lanthanides and actinides, coordination compounds, nitro compounds, food science and chemical kinetics	K1
CLO2	illustrate the extraction of lanthanides and actinides, theories of coordination compounds, preparation of nitro compounds, types of food additives and basics of chemical kinetics	K2
CLO3	Interpret the properties of lanthanides and actinides, coordination compounds, nitro compounds, food adulteration and determination of rate of a reaction	K3
CLO4	Compare and contrast lanthanides & actinides, high spin –low spin complexes, mono, di & trinitro compounds, food additives, theories of kinetics	K4

**Mapping with Programme Outcomes**

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	H	H	H	M
CLO2	H	H	H	H	H	M
CLO3	H	H	M	H	H	H
CLO4	H	H	H	M	H	H
CLO5	H	H	H	H	H	M

## GENERAL CHEMISTRY PAPER - IV

(58 Hrs)

### Unit - I

(12 Hrs)

#### Lanthanides and Actinides

Lanthanides: Lanthanide series, abundance and natural isotopes, lanthanide contraction, similarity in properties, occurrence, oxidation states, chemical properties of Ln(III) cations, magnetic properties. Colour and electronic spectra of lanthanide compounds, Lanthanide

contraction. Extraction of lanthanides from Monazite, separation of individual lanthanides by Ion exchange method. Lanthanum - occurrence, metallurgy, physical and chemical properties.

Actinides: Actinide series, abundance and natural isotopes, occurrence, oxidation states, preparation & properties of actinides and actinide contraction. Uranium - occurrence, metallurgy, physical and chemical properties.

**Comparison of lanthanides and actinides. Updation of periodic table from Web.**

### Unit - II

(12 Hrs)

#### Coordination Chemistry

Introduction - Types of ligands; coordination sphere; coordination number; nomenclature of mononuclear and di nuclear complexes; chelate effect. **Isomerism: linkage, ionization, hydrate, coordination, coordination position isomerism, geometrical and optical isomerism.**

Theories - Sidgwick theory - EAN and stability, Valence bond theory - hybridization, geometry, magnetism, drawbacks of VBT. Crystal field theory - crystal field effects, assumptions of crystal field theory, crystal field splitting in octahedral and tetrahedral geometries - high - spin and low - spin complexes, **factors affecting CFSE.**

### Unit – III

(12 Hrs)

#### Nitrocompounds, Amines and Diazonium Salts

Nitrocompounds: Aliphatic and aromatic nitro compounds - general methods of preparation, properties and uses.

## Amines

Primary, secondary and tertiary amines preparation and reactions. Separation of aliphatic amines - Hofmann and Hinsberg methods. Comparison of their basicity. Aromatic amines- Commercial preparation of aniline, reactions - Ring substitution, diazotization, coupling reactions of aromatic amines.

**Diazonium salts: Preparation from aromatic amines. Reactions: conversion to benzene, phenol, dyes.**

## Unit - IV

(11 hrs)

### Chemical Kinetics-I

Empirical laws and experimental aspects - order and molecularity of reactions. Setting up and solving simple differential equations for zero, first, second & third order reactions. Derivation for half-life periods of first, second, third and zero order. **Determination of order of reactions.** Arrhenius equation & concept of energy of activation. Collision theory & derivation of rate constant for bimolecular reactions-theory of absolute reaction rates- derivation for the rate constant in terms of partition functions.

## UNIT V

(11 Hrs)

### Introduction to Food Science

Functions of food - energy yielding, body building, protection and regulation, maintenance of health. Food groups, food guide pyramid, food in relation to health.

### Food Additives

Definition, need for additives, classification - preservatives, antioxidants, sequestrants, surface acting agents, bleaching and maturing agents, starch modifiers, flavoring agents and flavour enhancers, non-nutritive dietary sweeteners, nutrient supplements, food colours, stabilizers and thickeners, functions and uses of food additives.

### Food Adulteration and Testing

**Introduction, legal aspects and prevention, common food adulterants, analysis of various food adulterants in oils, ghee, coffee powder, chili powder, turmeric powder and meat.**

Harmful effects of the adulterants. Food additives- sweeteners, preservatives, flavors, colorants, pesticide contaminants and toxicants.

## Text Books

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	B.S. Bahl & Arun Bahl	Organic Chemistry	S.Chand & Co, 15 <sup>th</sup> Edn	2009
2	R. D. Madan	Modern Inorganic Chemistry	S. Chand & Co, 3 <sup>rd</sup> Edn	2011
3	B.R. Puri, L.R. Sharma,	Principles of Physical Chemistry	Vishal Publications,	2011
4	B. Srilakshmi	Food Science	New Age International Pvt	2003
5	Vijaya Khader	Text Book on Food Storage and	Kalyani Publishers 1 <sup>st</sup> Edn	1999

## Reference Books

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	Morrison, Boyd Bhattacharjee	Organic Chemistry	Pearson education	7 <sup>th</sup> edition 2011
2	Gardon M Barrow	Physical Chemistry	Tata Mcgraw Hill	5 <sup>th</sup> Edition 2010
3	Puri, Sharma, Kalia	Principles of Inorganic Chemistry	Vishal Publishing Co	33 <sup>rd</sup> Edition 2016

**Pedagogy:** Lecture by chalk and talk, power point presentation, e-content, group discussion, assignment, quiz, peer learning, student seminar, problem solving exercise

**Portion marked in Bold – Blended Learning**

**Course Designers:**

1. Dr. N. Arunadevi
2. Dr. G. Subashini

**Blended Learning**

**UNIT-I**

Unit No	Topic	Contents
I	Comparison of lanthanides and actinides,	You Tube Video <a href="https://www.youtube.com/watch?v=AE7aKG-tWqM">https://www.youtube.com/watch?v=AE7aKG-tWqM</a> <a href="https://www.youtube.com/watch?v=m45zQIEQJws">https://www.youtube.com/watch?v=m45zQIEQJws</a>
	Updation of periodic table from Web.	Google <a href="https://letstalkscience.ca/educational-resources/stem-in-context/newest-elements-on-periodic-table">https://letstalkscience.ca/educational-resources/stem-in-context/newest-elements-on-periodic-table</a>
II	Isomerism: linkage, ionization, hydrate, coordination, coordination position isomerism, geometrical and optical isomerism.	<a href="https://www.youtube.com/watch?v=n-lAbWjiNKA">https://www.youtube.com/watch?v=n-lAbWjiNKA</a> <a href="https://www.youtube.com/watch?v=FLVG08FjcoI">https://www.youtube.com/watch?v=FLVG08FjcoI</a> <a href="https://www.youtube.com/watch?v=PO9NYeb0Tdc">https://www.youtube.com/watch?v=PO9NYeb0Tdc</a>
	Factors affecting CFSE.	<a href="https://www.youtube.com/watch?v=qSvsEMxjPAY">https://www.youtube.com/watch?v=qSvsEMxjPAY</a> <a href="https://www.youtube.com/watch?v=5AG35BALLBI">https://www.youtube.com/watch?v=5AG35BALLBI</a>
III	Diazonium salts: Preparation from aromatic amines, reactions - conversion to benzene and phenol.	<a href="https://www.youtube.com/watch?v=8hJySbRvOHs">https://www.youtube.com/watch?v=8hJySbRvOHs</a> <a href="https://www.youtube.com/watch?v=jcMbEujYMmU">https://www.youtube.com/watch?v=jcMbEujYMmU</a>
IV	Determination of order of reactions.	<a href="https://www.youtube.com/watch?v=4wOb58n5eJA">https://www.youtube.com/watch?v=4wOb58n5eJA</a> <a href="https://www.youtube.com/watch?v=hovN5YQEzbQ">https://www.youtube.com/watch?v=hovN5YQEzbQ</a> <a href="https://www.youtube.com/watch?v=N2bLOeYkubg">https://www.youtube.com/watch?v=N2bLOeYkubg</a>
V	Food Adulteration and Testing Introduction, legal aspects and prevention, common food adulterants, analysis of various food adulterants in oils, ghee, coffee powder, chili powder, turmeric powder and meat.	<a href="https://www.youtube.com/watch?v=ue9cE7YdjNU">https://www.youtube.com/watch?v=ue9cE7YdjNU</a> <a href="https://slideplayer.com/slide/6081032/">https://slideplayer.com/slide/6081032/</a> <a href="https://www.youtube.com/watch?v=mSi-0P7gUIw">https://www.youtube.com/watch?v=mSi-0P7gUIw</a>

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
CE22SB02	Skill Based Subject Computational Chemistry II	THEORY	43	2	-	2

### Preamble

Enable the students to

- understand the use of informatics in drug design and development
- recognise the mechanism of drug designing
- understand the concept of molecular modelling, mechanics and interactions

### Course Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	understand the phases of drug design, features of molecular mechanics, energy concept, drug likeness and toxicity property of drugs.	K1
CLO2	recognize the mode of chemical interaction, new drug targets, coordinates system and potential energy surface, protein-ligand docking and hard/soft drugs	K2
CLO3	Identification of target and lead molecule, calculate the force field, molecular descriptors, drug likeness score	K3
CLO4	interpret the bonding and non-bonding interaction, “drug likeness” in chemical structure, analyze the properties of the chemical structure for drug activity	K4

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	H	H	M	H
CLO2	H	H	H	M	M	H
CLO3	H	H	H	M	M	H
CLO4	H	H	H	M	M	H

H - High; M-Medium; L-Low



## Semester IV

### Skill Based Subject

#### Computational Chemistry II (CE22SB02)

**Credits: 2**

**(43 Hrs)**

#### **Unit I**

**(8 Hrs)**

**Introduction to Molecular Modeling:** Molecular Modeling and Pharmacoinformatics in Drug Design, Phases of Drug Discovery, Target identification and validation, lead identification and optimization, finding of new drug targets.

#### **Unit II**

**(9 Hrs)**

**Concepts in Molecular Modeling:** Coordinate System; potential energy surfaces; molecular graphics; Quantum mechanics; **Molecular Mechanics:** Features of molecular mechanics, force fields.

#### **Unit III**

**(9 Hrs)**

#### **Molecular Interaction Parameters**

Bond structure and bending angles – electrostatic, van der Waals and non\_bonded interactions, hydrogen bonding, Inter and intramolecular interactions: Weak interactions in drug molecules; hydrogen bonding in molecular mechanics; Energy concept and its importance in drug action.

#### **Unit IV**

**(9 Hrs)**

**Virtual Screening:** Introduction, “Drug likeness” and compound filters, Structure based virtual screening – protein-ligand docking, scoring function for protein-ligand docking

#### **Unit V**

**(8Hrs)**

**Properties of drugs:** Concept of hard and soft drugs; Chemistry of ADME and toxicity properties of drugs. Lipinski rule, agonist and antagonist.

## Textbooks

S.No	Authors	Title of the Book	Publishers	Year of Publication
1.	Dan E Krane & Michael L Raymer	Fundamental concepts of Bioinformatics	Pearson Education	2003, 1 <sup>st</sup> Edn
2	Rajarsha Guha & Andreas Bender	Computational Approaches in Cheminformatics & Bioinformatics	Wiley India Pvt Ltd	2012 1 <sup>st</sup> edition

## Reference books

S.No	Authors	Title of the Book	Publishers	Year of Publication
1	Sundar Rajan S	Introduction to Bioinformatics	Himalaya Publishing House	2002, 1 <sup>st</sup> Edn

## Pedagogy

Lecture by chalk and talk, power point presentation, e-content, group learning, group discussion, assignment, quiz, peer learning, student seminar, problem solving exercise

## Course Designers

1. Dr. G. Sathya Priyadarshini
2. Dr Sowmya Ramkumar

**EVALUATION PATTERN**

TEST I (THEORY/PRACTICAL) : 50 Marks

TEST II(THEORY/PRACTICAL): 50 Marks

**TOTAL: 100 Marks**

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>CATEGORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
<b>CE22SBP1</b>	<b>Skill Based Subject Practical - Computational Chemistry Practical</b>	<b>PRACTICAL</b>	-	-	45	2

### Preamble

Enable the students to

- understand the essential features and tools of cheminformatics
- design chemical structures using chemical software

### Course Outcomes

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

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	recognize the tools used in cheminformatics software	K1
CLO2	represent the SMILE string for the chemical structure and vice versa	K2
CLO3	sketch out the code for chemical structures	K3
CLO4	interpret the minimum energy configuration and the hypothetical properties of chemical structures	K4

### Mapping with Programme Outcomes

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>	<b>PLO6</b>
CLO1	H	H	H	H	M	H
CLO2	H	H	H	H	M	H
CLO3	H	H	H	M	M	H

H - High; M-Medium; L-Low

## Semester V

### Skill Based Subject Practical

#### Computational Chemistry Practical I (CE22SBP1)

**Credits: 2**

**(45 Hrs)**

1. Graphical User Interface Display - Draw chemical structures using open source tools: Chem Sketch, Chem Draw, G Chempaint
2. Interconversion of name / SMILES code to structure and vice-versa using Chemdraw.
3. Optimization of chemical structures for minimum energy configuration.
4. Analysis of molecular properties of chemical structures – molecular formula, molecular weight, composition, molar volume, density and specific refractivity using Chem sketch.
5. Output in different file formats – SDF file, mol File, XYZ coordinates, PDB
6. Finding the Pharmacophore properties using Rule of Thumb
7. Studies on active site structural features using Autodock.

#### Textbook

S.No	Authors	Title of the Book	Publishers	Year of Publication
1.	Muthukumarasamy Karthikeya and RenuVyas	Practical Cheminformatics	Springer	2014

#### Pedagogy

Demonstration, Hands on training

#### Course Designers

1. Dr. G. Sathya Priyadarshini
2. Dr. Sowmya Ramkumar

#### EVALUATION PATTERN

TEST I (THEORY/PRACTICAL) : 50 Marks

TEST II(THEORY/PRACTICAL): 50 Marks

**TOTAL: 100 Marks**

COURSE NUMBER- NM22DTG	COURSE NAME – DESIGN THINKING	Category	L	T	P	Credit
		Theory	28	2	-	2

**Preamble:**

1. To expose the students to the concept of design thinking as a tool for innovation
2. To facilitate them to analyze the design process in decision making
3. To impart the design thinking skills

**Course Outcome**

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

CLO Number	CLO Statement	Knowledge Level
CLO 1	Understand the concepts of Design thinking and its application in varied business settings	K1
CLO 2	Describe the principles, basis of design thinking and its stages	K2
CLO 3	Apply design thinking process in problem solving	K3
CLO 4	Analyze the best practices of design thinking and impart them in business and individual day to day operations.	K4

**Mapping with Programme Outcomes**

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	S	M	M	S	S
CLO 2	M	S	S	M	M
CLO 3	S	S	S	M	S
CLO 4	S	S	S	S	S

S-Strong; M-Medium; L-Low

## NM21DTG - DESIGN THINKING

### UNIT – 1 (5 Hours)

Design Thinking Overview: **\*Introduction to Design Thinking\*** and Design Research Strategies -**\*Design Thinking Skills\***

### UNIT – II (5 Hours)

Design Thinking Mindset - **\*Principles of Design Thinking - Basis for design thinking\*** -  
**\*Design Thinking Hats\*** - Design thinking team

### UNIT – III (5 Hours)

**\*Empathize\*** - definition - Listen & Empathize with the Customers and / or Users - Tools and Techniques

### UNIT – IV (5 Hours)

**\*Define\*** - Definition - Defining the Problem - Tools and Techniques - Journey mapping and

**\*Ideate\*** - definition - Ideation techniques

### UNIT – V (6 Hours)

**\*Prototype\*** - Definition - Prototype Alternate Solutions - **\*Test the Solutions\*** - Visualization

- Story Telling - Cautions and Pitfalls - Best Practices

(\*Seminar - Internal evaluation only)

#### Text Books:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Christian Mueller-Roterberg	Handbook of Design Thinking Tips & Tools for how to design thinking	Amazon Kindle Version	2018
2	Gavin Ambrose Paul Harris	Design Thinking	AVA Publishing Switzerland	2010

#### Reference Books:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Maurício Vianna Ysmar Vianna Isabel K. Adler Brenda Lucena Beatriz Russo	Design Thinking - Business Innovation	MJV Press	2011
2	Moritz Gekeler	A practical guide to design thinking	Friedrich- Ebert- Stiftung	2019
3	J. Berengueres	The Brown Book of Design Thinking	UAE University College, Al Ain	2014

**Design Thinking – Finishing**  
**School Assessment pattern**  
**CA – 100 marks**

**\*Project – 25 marks**

<b>Stage</b>	<b>Marks</b>
Stage 1 – Empathize	5
Stage 2 – Define	5
Stage 3 – Ideate	5
Stage 4 – Prototype	5
Stage 5 - Test	5
<b>Total</b>	<b>25 marks</b>

\*Group project – Maximum 6 students per team, concept note of the project has to be approved by the HoD before the start of the project

**INTERNAL COMPONENT**  
**MARKS**

Quiz	50
Assignment	25
Project/Case Study	25
<b>TOTAL</b>	<b>100</b>