

Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.
Accredited with A⁺ by NAAC - IV cycle – CGPA 3.35

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli



DEPARTMENT OF CHEMISTRY

SYLLABUS FOR UNDERGRADUATE PROGRAMME



TEACHING PLAN

EVEN SEMESTER 2024 – 2025

Vision

- Impart quality education, scientific skills, academic excellence, research attitude and skills to face global challenges.

Mission

- To develop intellectual and professional skills of the students
- To provide a firm foundation in chemical concepts, laws and theories
- To sharpen the scientific knowledge
- To enhance critical thinking, problem solving ability, scientific temper and innovation
- To apply chemistry in medicine, biology, industry and environment

Programme Educational Objectives (PEOs)

PEOs	Upon completion of B.A/B.Sc. Degree Programme, the graduates will be able to	Mapping with Mission
PEO 1	apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.	M1& M2
PEO 2	use practical knowledge for developing professional empowerment and entrepreneurship and societal services.	M2, M3, M4 & M5
PEO 3	pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.	M3, M4, M5 & M6

Programme Outcomes (POs)

POs	Upon completion of B.Sc. Degree Programme, the graduates will be able to:	Mapping with PEOs
PO1	obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.	PEO1
PO2	create innovative ideas to enhance entrepreneurial skills for economic independence.	PEO2
PO3	reflect upon green initiatives and take responsible steps to build a sustainable environment.	PEO2
PO4	enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career.	PEO1 & PEO3
PO5	communicate effectively and collaborate successfully with peers to become competent professionals.	PEO2 & PEO3
PO6	absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	PEO2 & PEO3
PO7	participate in learning activities throughout life, through self-paced and self-directed learning to improve knowledge and skills.	PEO1 & PEO3

Programme Specific Outcomes (PSOs)

PSOs	Upon completion of B.Sc Chemistry programme, the graduates will be able to:	Mapping with POs
PSO - 1	understand the fundamentals, theories and principles of organic, inorganic and physical chemistry.	PO1
PSO - 2	analyze physical and chemical properties of chemical compounds and their uses.	PO1& PO7
PSO - 3	interpret the mechanism of various chemical reactions.	PO3 &PO4
PSO - 4	synthesize organic and inorganic compounds using classical and modern methods.	PO2
PSO - 5	design and carry out scientific experiments, record and interpret the results with accuracy	PO1& PO4
PSO - 6	use concepts, tools and techniques related to chemistry to other branches of science.	PO5
PSO - 7	develop skills in the safe-handling of chemicals and their usage in day today life.	PO1&PO7
PSO - 8	develop entrepreneurial skills, empowered to fulfil the professional requirement and become self-dependent.	PO2& PO6

Department : **Chemistry**
Class : **I B.Sc Chemistry**
Title of the Course : **General Chemistry-II**
Semester : **II**
Course Code : **CU232CC1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU232CC1	5	-	-	-	5	5	75	25	75	100

Learning Objectives

1. To understand the chemistry of acids, bases and ionic equilibrium
2. To know the chemistry of hydrocarbons, applications of acids and bases

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO - 1	explain the concept of acids, bases and ionic equilibria; periodic properties of s and pblock elements, preparation and properties of aliphatic and aromatic hydrocarbons	PSO-1	K1
CO - 2	discuss the periodic properties of s and p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids	PSO-2	K2
CO - 3	classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons	PSO-3	K3
CO - 4	explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements	PSO-4	K3
CO - 5	assess the application of acids, indicators, buffers, compounds of s and p- block elements and hydrocarbons	PSO-4	K4

Teaching plan

Total Contact hours: 75 hrs(Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	Acids, bases and Ionic equilibria					
	1	Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant	3	K2(U)	Lecture using models, chalk and talk	Slip test and concept explanations
	2	Ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators,	2	K3(A)	Group discussion and problem solving	Problem solving
	3	Theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators;	3	K1(R)	Lecture using chalk and talk	Short test
	4	Buffer solutions– types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation; Salt hydrolysis	3	K2(U)	Lecture using chalk and talk	Slip test and MCQ
	5	Salts of weak acids and strong bases, weak bases and strong acids hydrolysis constant - degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis	3	K3(A)	Lecture using chalk and talk, group discussion and problem solving	Group discussion and problem solving
	6	Solubility product - determination and applications; numerical problems involving the core concepts.	2	K3(A)	Lecture using models, chalk and talk	Concept explanations and slip test
II	Chemistry of s and p- Block Elements					
	1	Hydrogen: Position of hydrogen in the periodic table. General characteristics of alkali metals and alkaline earth metals-Electronic configuration, oxidation states,	3	K2(U)	Lecture using chalk and talk	Short test
	2	Ionisation energy, reducing property, flame colouration, uses of alkali metals. Comparative study of oxides and hydroxides of alkali metals.	3	K4(An)	Lecture using chalk and talk	Mentimeter

	3	Diagonal relationship of Li with Mg. Preparation, properties and uses of sodium cyanide, sodamide and potassium cyanide. Extraction of Be and its uses..	2	K2(U)	Lecture using chalk and talk	Short test and MCQ
	4	General characteristics of p-Block Elements (Group 13 & 14)- Electronic configuration, oxidation states and metallic character, preparation and structure of diborane and borazine. Chemistry of borax	4	K2(U)	Lecture using chalk and talk	Short test and quiz
	5	Extraction of Al and its uses. Comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses.	3	K4(An)	Lecture using chalk and talk	Slip test
III	Chemistry of p- Block Elements (Group 15-18)					
	1	General characteristics of elements of Group 15; chemistry of $\text{H}_2\text{N-NH}_2$, NH_2OH and HNO_3 . Chemistry of PH_3 , PCl_3 , PCl_5 , POCl_3 and P_2O_5	3	K1(R)	Lecture using chalk and talk	Concept explanation
	2	Oxy acids of phosphorous (H_3PO_3 and H_3PO_4). General properties of elements of group16 - chemistry of ozone	3	K2(U)	Lecture using chalk and talk, Group discussion	Slip test
	3	Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens	3	K3(A)	Lecture using powerpoint	Short test
	4	General characteristics of halogen with reference to electronegativity, electron affinity and oxidation states. Peculiarities of fluorine.	3	K1(R)	Lecture using chalk and talk , Seminar	Slip test and quiz- google forms
	5	Inter-halogen compounds (ICl , ClF_3 , BrF_5 and IF_7),pseudo halogens. Noble gases: Position in the periodic table-uses of noble gases.	3	K2(U)	Lecture using chalk and talk	Concept explanation
IV	Hydrocarbon Chemistry-I					

	1	Petroproducts: Fractional distillation of petroleum; cracking, Alkenes-Nomenclature, general methods of preparation –	3	K2(U)	Lecture using power point	Slip test
	2	Mechanism of β - elimination reactions – E ₁ and E ₂ mechanism - orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms	4	K1(R)	Lecture using chalk and talk	Slip test and quiz
	3	Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, epoxidation, ozonolysis; polymerization.	3	K3(A)	Lecture using chalk and talk	Short test
	4	Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene. Alkynes Nomenclature; general methods of preparation (any two) and reactions;	2	K2(U)	Lecture using chalk and talk	Group discussion , slido
	5	Acidic nature of terminal alkynes and acetylene. Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations.	3	K3(A)	Lecture using chalk and talk, Seminar	Short test
V	Hydrocarbon Chemistry - II					
	1	Benzene: structure of benzene, stability of benzene ring, aromaticity, Huckel's (4n+2) rule.	2	K2(U)	Lecture using chalk and talk	Slip test
	2	Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation,	2	K2(U)	Lecture using powerpoint, Seminar	Concept explanation
	3	Halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene	3	K2(U)	Lecture using chalk and talk, Group discussion	MCQ- Google forms
	4	Effect of substituent – orientation and reactivity. Polynuclear Aromatic hydrocarbons: Naphthalene –Haworth synthesis;	4	K3(A)	Lecture using chalk and talk	Short test
	5	Reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation,	2	K3(A)	Lecture using chalk and talk	Short test
	6	Friedel – Crafts acylation, alkylation, and oxidation – uses. Anthracene – synthesis by	2	K2(U)	Power point	Long answer test

		Haworth synthesis; reactions - Diels-Alder reaction -uses.				
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Course Focussing on Employability/ Entrepreneurship/ Skill Development :

Employability

Activities: Group Discussion, Assignment, Seminar

Assignment :

1. Electronic configuration s-block elements.
2. Buffer solutions
3. Benzene and its reactions

Seminar Topic:

1. Markownikoff's rule
2. Karash Effect
3. Chemistry of Naphthalene

Sample questions

Part A

1. Lewis acid is an electron pair -----.
2. Ammonium chloride and ammonium hydroxide is an example for basic buffer. Say true or false.
3. The first element in the periodic table is-----.
(a) Lithium (b) Hydrogen (c) Helium (d) Sodium
4. The ionisation energy of s block elements -----along a period.
5. An example of inter halogen compound is -----.
(a) PCl_3 (b) N_2O_5 (c) IF_7 (d) PH_3
6. Marshall's acid is an example of oxyacid of sulphur. Say true or false.
7. Natural rubber is made up of isoprene units. Say true or false.
8. Ozonolysis of alkene gives -----.
(a) aldehydes (b) acid (c) halogens (d) ester
9. Naphthalene is an example for polynuclear hydrocarbon. Say true or false.
10. Nitrating agent is a mixture of -----.

Part B

1. Explain the theory of acid base indicators.
2. Write notes on (i) Ionic product of water (ii) Buffer action
3. Give the flame colouration of alkali and alkaline earth metals.
4. Explain the structure of diborane.
5. Write notes on Caro's acid and Marshall's acid
6. What are pseudo halogens? Explain them.
7. Write notes on Markownikoff's rule and Karash effect.
8. What do you mean by Hofmann and Saytzeff rule?

9. Explain the structure of benzene.
10. Give the mechanism of i) nitration and ii) Friedel crafts alkylation

Part C

1. Derive Henderson Hasselbalch equation.
2. Mention the applications of solubility product.
3. How is aluminium extracted from its ore? Mention the uses.
4. Compare carbon with that of silicon.
5. List out the peculiarities of fluorine.
6. Explain the position of noble gases in the periodic table.
7. Explain Bayer's strain theory on the basis of relative stability of alkanes.
8. Give any two methods of preparation of alkenes. Explain E1 and E2 reactions.
9. How is naphthalene prepared by Haworth synthesis? Explain the oxidation, alkylation and acylation reactions.
10. Explain electrophilic substitution reactions with examples.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. L. Deva Vijila

Department : **Chemistry**
Class : **I B.Sc Chemistry**
Title of the Course : **Dairy Chemistry**
Semester : **II**
Course Code : **CU232SE1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU232SE1	1	-	1	-	2	2	30	25	75	100

Learning Objectives

1. To understand the composition and processing of milk.
2. To know the constituents and manufacturing process of milk and milk products.

Course Outcomes

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	Remember the composition of milk and its processing	PSO - 1	K1
CO - 2	Understand the physio-chemical properties, pasteurization process and manufacture of milk and milk products	PSO - 3	K2
CO - 3	Apply the procedure for milk processing and determine the adulterants present in dairy products	PSO - 4	K1
CO - 4	Analyse the ingredients, nutritive values and manufacture of special milks and dairy products	PSO - 5	K2
CO - 5	Evaluate fat, SNF, specific gravity, acidity, pH, surface tension, viscosity and physio-chemical properties of milk and milk products.	PSO - 2	K3

Teaching plan

Total Contact hours: 30 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Composition of Milk					
	1	Milk - definition - general composition of milk	1	K1(R)	Lecture with ppt	Oral test
	2	constituents of milk - lipids, proteins	1	K2(U)	Lecture using chalk and talk	Slip test

	3	carbohydrates, vitamins and minerals	1	K2(U)	Seminar	Short test
	4	physical properties of milk - colour, odour, acidity	1	K3(Ap)	Demonstration	Oral test and MCQ
	5	specific gravity, viscosity and conductivity -	1	K4(An)	Lecture using chalk and talk	Short test through slido
	6	Factors affecting the composition of milk.	1	K3(Ap)	Lecture using chalk and talk	Short test
II	Processing of Milk					
	1	Microbiology of milk - destruction of micro - organisms in milk	1	K2(U)	Lecture using chalk and talk	Oral test
	2	physico-chemical changes taking place in milk due to processing - boiling	1	K4(An)	Lecture using ppt	Quizon Kahoot
	3	pasteurization - types of pasteurization	1	K4(An)	Seminar	Short test and MCQ in google form
	4	Bottle, Batch and High Temperature Short Time (HTST)	1	K3(Ap)	Exhibition of vitamin sources	Short summary
	5	Vacuum pasteurization	1	K3(Ap)	Lecture using videos	Short test and quiz through nearpod
	6	Ultra High Temperature (UHT) pasteurization	1	K1(K)	Seminar	Short Test
III	Major Milk Products					
	1	Cream - definition - composition - chemistry of creaming process	1	K1(R)	Lecture using videos	Short test
	2	Gravitational and centrifugal methods of separation of cream.	1	K2(U)	Seminar	Oral test
	3	Butter - definition - composition - theory of churning	1	K3(Ap)	Demonstration on estimation of oil	Short test
	4	Desi butter - salted butter, estimation of acidity and moisture content in butter	1	K3(Ap)	Lecture using ppt	Quiz through Quizzes

	5	Ghee - major constituents	1	K2(U)	Lecture using chalk and talk	Group discussion
	6	common adulterants added to ghee and their detection.	1	K1(R)	Seminar	Class test
IV	Special Milk					
	1	Standardised milk - definition - merits	1	K1(R)	Lecture using chalk and talk	Slip test
	2	Reconstituted milk - definition - flow diagram of manufacture	1	K4(An)	Seminar	Group discussion
	3	Homogenised milk - flavoured milk - vitaminised milk	1	K4(An)	Lecture using videos	Short test
	4	Toned milk - Incitation milk	1	K3(Ap)	Lecture using ppt	Oral test
	5	Vegetable toned milk - humanized milk	1	K1(R)	Seminar	Slip test
	6	Condensed milk - definition, composition and nutritive value.	1	K3(Ap)	Lecture using chalk and talk	Quizzes
V	Estimation and Preparation of milk and milk products					
	1	Estimation of fat, SNF	1	K1(R)	Lecture using ppt	Slip test
	2	specific gravity and acidity of milk	1	K2(U)	Lecture using chalk and talk	Short test
	3	Determination of pH, surface tension and viscosity of milk	1	K4(An)	Lecture using videos	MCQ through Slido
	4	Preparation of butter - ghee - milk powder and ice cream.	1	K2(U)	Group Discussion	Short summary
	5	Preparation of indigenous milk products	1	K3(Ap)	Problem solving	Slip test
	6	khoa - chhena - paneer and kulfi	1	K3(Ap)	Seminar	MCQ

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities (Em): Group discussion and Seminar

Assignment:

1. Constituents of milk - lipids, proteins
2. Estimation of fat, SNF
3. Preparation of indigenous milk products

Seminar:

1. Pasteurization - types of pasteurization
2. Ultra High Temperature (UHT) pasteurization
3. Gravitational and centrifugal methods of separation of cream.
4. Common adulterants added to ghee and their detection
5. Preparation of indigenous milk products

Sample questions

Part- A

1. Pasteurization is done to improve the _____ quality of milk.
2. Pasteurized milk should give positive phosphatase test. Say true or false.
3. In batch pasteurization, milk is heated to 63 °C for
a) 15 min b) 15 sec c) 30 min d) 30 sec
4. The cooling temperature of milk is _____
5. In HTST method of pasteurization this is used for diverting unpasteurized milk.
a) FTBC b) FDV c) FDP d) FCP
6. Double toned milk should contain _____ % of fat.
a) 3% b) 1.5% c) 9% d) 8.5%
7. The term condensed milk refers to full cream _____
a) unsweetened condensed milk b) unsweetened skim milk
c) Sweetened condensed milk d) sweetened skim milk
8. Deficiency of pyridoxine causes _____
a) pellagra b) cheilosis c) anaemia d) depression
9. Vitamin B12 is otherwise known as _____
a) pyridoxime b) Niacin c) cyanocobalamine d) Thiamine
10. Sweetened condensed skim milk is the produce of _____
a) cow skimmed milk b) goat condensed milk
c) cow condensed milk d) goat skimmed milk

Part - B

1. Explain the physical properties of milk.
2. List out the types of milk.
3. List out the constituents of milk.

4. Define pasteurization.
5. Differentiate HTST and UHT pasteurization techniques.
6. Compare bottle and batch pasteurization process.
7. Define rancidity.
8. Explain the theory of churning for the conversion of cream into butter.
9. How will you detect the adulterants present in ghee?
10. Compare gravitational and centrifugal methods for the separation of cream.
11. Highlight the merits of standardized milk.
12. Differentiate homogenized and flavoured milks.
13. 13. Compare bulgariou and acidophilous milks

Part - C

1. How will you determine the adulterants present in milk?
2. Analyze the factors which affect the composition of milk.
3. Describe the physio-chemical changes takes place in milk while processing.
4. Determine the acidity and moisture content present in butter.
5. Illustrate the manufacture of reconstituted milk with a flow chart
6. Compare the composition of vitaminised, toned and humanized milks. What is fermentation of milk? Summarize the process involved in the fermentation of milk
7. Illustrate the procedure for the manufacture of ice cream. Analyze the role of stabilizers and emulsifiers in ice cream.
8. Illustrate the procedure for the destruction of microorganism present in milk.
9. Estimate the fat content and total solids present in milk.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. L. Deva Vijila

Department : **Chemistry**
Class : **Elective Course II: Botany and Zoology Major**
Title of the Course : **Chemistry for Biological Sciences - II**
Semester : **II**
Course Code : **CU232EC1**

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
CU232EC1	4	-	-	3	4	60	25	75	100

Learning Objectives

1. understand the characteristics and structure of nucleic acids, amino acid and vitamins
2. understand the biological functions of lipids and fundamentals of photochemistry

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	remember the importance of amino acids and learn the basic concepts of Ayurveda	PSO - 1	K1
CO - 2	understand the importance of nucleic acids and vitamins	PSO - 3	K2
CO - 3	know the biological functions of lipids, oils and fats	PSO - 1	K1
CO - 4	understand the function and deficiency of metals in human system	PSO - 6	K2
CO - 5	outline the various type of photochemical process.	PSO - 2	K3

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	Amino Acids and Essential elements of biosystem					
	1	Classification - preparation and properties of alanine	3	K1(R)	Lecture with ppt	Oral test
	2	preparation of dipeptides using Bergmann method	2	K2(U)	Lecture using chalk and talk	Slip test
	3	Proteins- classification – structure	2	K2(U)	Seminar	Short test

	4	Colour reactions – Biological functions of proteins.	2	K3(Ap)	Demonstration	Oral test and MCQ
	5	Basic concepts of Ayurveda, Important test of Ayurveda and Ayurvedic view of the cause of diseases.	3	K4(An)	Lecture using chalk and talk	Short test through slido
II	Nucleic acids and Vitamins					
	1	Nucleic acids –nucleosides and nucleotides. Structure of DNA - denaturation and renaturation of DNA - replication of DNA. Hydrogen bonding in DNA.	3	K2(U)	Lecture using chalk and talk	Oral test
	2	Stabilizing forces in protein and DNA - Vander waal's forces, dipole-dipole and dipole-induced dipole interactions.	3	K4(An)	Lecture using ppt	Quiz on Kahoot
	3	Structure of RNA - Types of RNA. Difference between DNA and RNA.	3	K4(An)	Seminar	Short test and MCQ in google form
	4	Vitamins: Classification, source, biological functions of Vitamin A, B, C, D, E and K.	2	K3(Ap)	Exhibition of vitamin sources	Short summary
	5	Diseases caused by the deficiency of Vitamin A, B, C, D, E and K.	1	K3(Ap)	Lecture using videos	Short test and quiz through nearpod
III	Lipids, oils and fats					
	1	Lipids - classification - properties - biological functions. Biological functions of phospholipids and glycolipids.	3	K1(R)	Lecture using videos	Short test
	2	Oils and fats - definition - characteristics and uses. Common fatty acids in oils and fats.	3	K2(U)	Seminar	Oral test
	3	Extraction and refining of oils. Estimation of fats and oils - acid value, saponification value and Iodine value.	3	K3(Ap)	Demonstration on estimation of oil	Short test
	4	Distinction between animal and vegetable fats. Hydrogenation and Rancidity.	3	K3(Ap)	Lecture using ppt	Quiz through Quizzes
IV	Minerals and water					
	1	Minerals: Introduction – source, function, deficiency and toxicity of calcium.	3	K1(R)	Lecture using chalk and talk	Slip test
	2	deficiency and toxicity of phosphorous, sodium, potassium, iron and iodine.	3	K4(An)	Seminar	Group discussion

	3	Water: Source and distribution of water in the body – functions of water	3	K4(An)	Lecture using videos	Short test
	4	absorption, metabolism and storage of water.	3	K3(Ap)	Lecture using ppt	Oral test
V	Photochemistry					
	1	Importance of photochemistry. Difference between thermal and photochemical reactions. Laws of photochemistry -Beer-Lambert's Law	2	K1(R)	Lecture using ppt	Slip test
	2	Grother's-Drapers law -Stark-Einstein's law - quantum efficiency.	2	K2(U)	Lecture using chalk and talk	Short test
	3	Electronic excitations - singlet and triplet states - Jablonski diagram - internal conversion - intersystem crossing	2	K4(An)	Lecture using videos	MCQ through Slido
	4	fluorescence - phosphorescence. Difference between fluorescence and phosphorescence.	2	K2(U)	Group Discussion	Short summary
	5	Photochemical rate law - kinetics of photochemical combination of H ₂ and Cl ₂ - decomposition of HI.	2	K3(Ap)	Problem solving	Slip test
	6	Photosensitization - photosensitizers - chemiluminescence - bioluminescence.	2	K3(Ap)	Seminar	MCQ

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities (Em): Group discussion and Seminar

Assignment:

1. Estimation of fats and oils - acid value, saponification value and Iodine value - Practical Assignments
2. Classification, source, biological functions of Vitamin A, B, C, D, E and K. – Analysis of food samples

Seminar

1. Proteins- classification – structure
2. Oils and fats - definition - characteristics and uses. Common fatty acids in oils and fats.
3. Structure of RNA - Types of RNA. Difference between DNA and RNA.
4. deficiency and toxicity of phosphorous, sodium, potassium, iron and iodine.
5. Photosensitization - photosensitizers - chemiluminescence - bioluminescence

Sample questions

Part A

1. These are polyamides formed by the condensation of – NH₂ group of one amino acid with the – COOH group of the other.
a) Proteins b) Peptides c) Carbohydrates d) Fats
2. Proteins are complex organic nitrogenous substances found in animal and plant tissues. Say true or false.
3. Nucleosides containing _____ sugar are called ribonucleotides.
a) Glucose b) Ribose c) Arabinose d) Maltose
4. DNA is a polymer of _____ .
5. Oxidation of unsaturated fatty acids yield _____.
(a) Peroxides (b) Carboxylic acid (c) Lipids (d) Phenol
6. Suitability of an oil for soap making is defined by _____.
(a) Iodine value (b) Saponification value
(c) Acid Value (d) Reichert – Meissel value
7. The reason for the greenish yellow glowing of yellow phosphorous.
a) Reduction of phosphorous (b) oxidation of phosphorous
(c) Addition of phosphorous (d) removal of phosphorous
8. What is the quantum yield for the photochemical decomposition of hydrogen iodide?
a) 1 (b) 2 (c) 3 (d) 4

9. Match the following

- | | | |
|-------------------|---|-----------------------------|
| Fluorescence | - | blue light |
| Secondary process | - | has unit quantum efficiency |
| Fluorspar | - | instantaneous process |
| Primary process | - | thermal radiation |
| Incandescence | - | temperature dependent |
10. Primary process of photochemical reaction is independent of temperature. Say true or false

Part B

1. Define the following:
i. Acid value ii. Saponification value iii. Iodine value
2. What is rancidity? Explain
3. Write notes on nucleosides.
4. List the important characteristics of fluorescence.
5. Define photosensitization with few examples

Part C

1. Give any three methods of synthesis of amino acids (i) glycine (ii) alanine and (iii) phenylalanine.
2. Write in detail the function, metabolism and storage of water in the body.
3. How will you extract oil from their sources?
4. Explain the structure of DNA using Watson and Crick model.
5. Give the mechanism of photochemical combination of H₂ and Cl₂.

Head of the Department: Dr. M. Anitha Malbi

Course Instructor: Dr. Ajith Sinthuja

Department : **Chemistry**
Title of the Course : **NME - Cosmetics and Personal Grooming**
Semester : **II**
Course Code : **CU232NM1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU232NM1	2				2	2	30	25	75	100

Learning Objectives:

1. To provide basic knowledge of cosmetics.
2. To know the chemicals present in hair and skin care products

Course Outcomes

COs	<i>Upon completion of this course, the students will be able to:</i>	PSO addressed	Cognitive level
CO - 1	Remember the composition of various chemicals in cosmetic products	PSO -2	K1(R)
CO - 2	Understand the methods of beauty treatments and their advantages and disadvantages	PSO -1	K2(U)
CO - 3	Apply the functions of various chemicals in cosmetics	PSO -4	K3(A)
CO - 4	Analyze the advantages and disadvantages of cosmetics	PSO -2	K4(An)
CO - 5	Evaluate the quality of cosmetics on the basis of their chemical composition	PSO -2	K5(E)

Teaching plan

Total Contact hours: 30 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Skin care					
	1	Nutrition of the skin, skin care and cleansing of the skin; face powder – ingredients; creams and lotions – cleansing, moisturizing all purpose,	2	K2(U)	lecture using chalk and talk	Slip test and concept explanations
	2	shaving and sunscreen (formulation only); Gels – formulation and advantages; astringent and skin tonics – key ingredients,	2	K3(A)	Seminar	class test

	3	skin lightness, depilatories. Hazards of skin care products.	2	K4(An)	lecture using chalk and talk	Short test
II	Hair care					
	1	Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients – Hair dye.	3	K2(U)	Lecture using videos and ppt	Quiz - Quizizz and slip test
	2	Disadvantages of hair care products.	1	K2(U)	Lecture using chalk and talk	Slip test and class test
	3	Dental care Tooth pastes – ingredients and preparation of tooth paste – mouth wash	2	K3(A)	Group discussion	Quiz and slip test
III	Make up					
	1	Base – foundation – types- liquid - powder – stick.	3	K2(U)	Lecture using ppt	Concept explanations
	2	In gredients, lipstick, eyeliner, mascara, eye shadow, concealers, rouge.	3	K4(An)	Seminar	Slip test
IV	Perfumes					
	1	Classification - Natural – plant origin – parts of the plant used – isolation of essential oils	4	K2(U)	Lecture using videos and ppt	Concept explanations and short summary
	2	Preparation of odorous substances – methyl anthranilate-citronellol-coumarin-vanillin-diphenyl oxide.	2	K4(An)	Lecture using chalk and talk	Slip test and quiz
V	Beauty treatments					
	1	Facials - types – advantages – disadvantages; face masks – types	2	K3(A)	Group discussion	slip test
	2	Bleach -types – advantages– disadvantages; shaping the brows; eyelash tinting; perming types;	2	K2(U)	Lecture using chalk and talk	Short test

	3	Hair colouring and dyeing ; permanent waving – hair straightening; wax types – waxing; pedicure, manicure - advantages – disadvantages	2	K6(C)	Group discussion, and Peer tutoring	Quiz - Slido
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Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities (Em/SD): Think-Pair-Share and Seminar

Assignment: (Mention Topic and Type)

Disadvantages of hair care products

Seminar: (Mention Topic)

Unit :I

Gels – formulation and advantages; astringent and skin tonics – key ingredients

Unit :IV

Ingredients, lipstick, eyeliner, mascara, eye shadow, concealers, rouge – therapeutic uses

Sample questions

Part - A

- The absorbent used for the talcum powder is -----
a) Magnesium carbonate b) Sodalime c) Lavender oil d) Zinc oxide
- The lotion used to protect against sun burn is -----
a)Sun screen lotion b) Shaving cream c) Face cream d) Body lotion
- A chemical substance used to lighten the skin is skin bleaching agents. State true or false.
- The pigment present in black and brown mascaras are ----- .
a) Iron oxide 50 b) Silver oxide c) Paraffin 30 d) Lead acetate
- Abrasives are used to polish the surface of teeth. State true or false.

Part - B

- Explain the ingredients present in talcum powder.
- Illustrate the preparation and uses of Skin bleaching agents.
- Discuss the preparation and uses of hair dye.
- List out types of shampoos.
- Explain the advantages of skin care products.
- Write a note on Astringents.

Part - C

- Explain the disadvantages of hair products.
- Discuss the ingredients present tooth paste.
- Compare the advantages and disadvantages of beauty products.
- Explain the preparation of methyl anthranilate and citronellol.
- Explain ingredients present in lipstick, eyeliner, mascara and eye shadow.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr.Y.Christabel Shaji

Department : Chemistry
Class : II B.Sc Chemistry
Title of the Course : General Chemistry - IV
Semester : IV
Course Code : CU234CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU234CC1	5	-	-	-	5	5	75	25	75	100

Pre-requisite: General Chemistry III

Learning Objectives:

1. To provide a comprehensive knowledge on thermodynamic concepts and transition elements
2. To know the organic chemistry of ethers, aldehydes, ketones and carboxylic acids

Course Outcomes

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	define the terms in thermodynamics, periodic properties of transition elements and to recognize the properties of aldehydes, ketones and carboxylic acids.	PSO 1	K1
CO - 2	discuss the fundamentals in the chemistry of ethers, epoxides and carbonyl compounds and to understand the principles behind thermodynamics	PSO 2	K2
CO - 3	apply the laws of thermodynamics and to synthesise various organic compounds	PSO 3	K3
CO - 4	classify transition elements into series and to analyse the properties of ethers, acids, epoxides, halogen derivatives and thermodynamical concepts	PSO 5	K4
CO - 5	determine the thermodynamic relations and to evaluate the oxidation, reduction and other properties of organic compounds	PSO 6	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 – Analyze, K5 - Evaluate

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	Thermodynamics I					
	1	Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes	3	K2(U)	Lecture using Chalk and talk	Evaluation through short test
	2	First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions	3	K3(A)	Lecture using chalk and talk	Short test
	3	Relation between heat capacities (C _p & C _v); Joule Thomson effect- inversion temperature.	3	K3(A)	Flipped classroom and lecture using chalk and talk	Evaluation through MCQ
	4	Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications	3	K3(A)	Group Discussion	Slip test and MCQ
	5	Effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications.	3	K4(An)	Lecture using chalk and talk	Group discussion and short test
II	Thermodynamics II					
	1	Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle	3	K4(An)	Lecture using videos and ppt	Short summary or overview
	2	Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas	4	K2(U)	Lecture using chalk and talk	Slip test and class test

		with changes in temperature, volume and pressure, entropy and disorder				
	3	Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity	3	K2(U)	Group discussion and problem solving	MCQ
	4	Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships.	2	K3(A)	Lecture using chalk and talk	Short test and quiz
	5	Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.	3	K4(An)	Problem-solving questions	Short summary or overview
III	General Characteristics of d-block elements					
	1	Transition Elements - Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes	4	K2(U)	Lecture using ppt	Concept explanations
	2	Comparative study of transition elements and non-transition elements – comparison of II and III transition series with I transition series	4	K3(A)	Group Discussion & Lecture using chalk and talk	Slip test
	3	Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups.	4	K4(An)	Lecture using chalk and talk	Short summary or overview
	4	Extraction and uses of Titanium, Vanadium and Chromium.	3	K3(A)	Lecture using chalk and talk	Slip test and quiz
IV	Ethers and Thio ethers & Aldehydes and Ketones					

	1	Ethers-Nomenclature, general methods of preparations, (any two) Zeisel's method of estimation of methoxy group	4	K2(U)	Lecture using videos and ppt	Concept explanations and short summary
	2	Thioethers - nomenclature, structure, preparation and uses. Aldehydes and Ketones- General methods of preparation and physical properties.	4	K3(A)	Lecture using chalk and talk	Slip test and quiz
	3	Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction and Knoevenagel reaction.	3	K2(U)	Lecture using chalk and talk	Short summary
	4	Clemmensen reduction, Wolf - Kishner reduction, Meerwein-Ponndorf Verley reduction, reduction with LiAlH ₄ and NaBH ₄ . Addition reactions of unsaturated carbonyl compounds: Michael addition.	4	K3(A)	Lecture using chalk and talk, mind mapping and group discussion	Group discussion and class test
V	Carboxylic Acids, Carboxylic acid Derivatives & Halogen substituted acids					
	1	Carboxylic Acids- Structure, preparation, acidic nature, HVZ reaction, Claisen ester condensation, and decarboxylation and	3	K2(U)	Introductory session Lecture using videos and ppt	Short test
	2	Carboxylic acid Derivatives: Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides	4	K2(U)	Lecture using chalk and talk	Class test
	3	Schottan - Baumann reaction, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement	4	K2(U)	Lecture using chalk and talk & Group Discussion	Problem-solving questions
	4	Halogen substituted acids – alpha, Beta halogenated substituted acids, Preparation and properties	4	K3(A)	Lecture using chalk and talk	Slip test

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability and Skill Development

Activities (Em/SD): Interactive discussion - Isolated, closed and open systems

Assignment: Hunsdiecker reaction- Reflective writing

Sample questions

PART A

1. Which property is most characteristic of transition elements?
 - a. Low melting and boiling points
 - b. Formation of colored ions
 - c. Low density
 - d. Lack of catalytic properties
2. Titanium is extracted using _____
 - a. Blast furnace process
 - b. Hall-Héroult process
 - c. Kroll process
 - d. Cyanide process
3. In Zeisel's method, which group is estimated?
 - a. Ethoxy group
 - b. Hydroxyl group
 - c. Methoxy group
 - d. Amino group
4. Which reagent is used in the Clemmensen reduction?
 - a. Zn-Hg/Conc. HCl
 - b. LiAlH_4
 - c. NaBH_4
 - d. KMnO_4
5. Claisen condensation involves the reaction of:
 - a. Two ketones
 - b. Two esters
 - c. An ester and a ketone
 - d. A carboxylic acid and an alcohol
6. Assertion (A): Michael addition involves the addition of a nucleophile to an α,β -unsaturated carbonyl compound.

Reason (R): The β -carbon of α,β -unsaturated carbonyl compounds is electrophilic due to conjugation with the carbonyl group.

Both A and R are true, and R is the correct explanation of A.

Both A and R are true, but R is not the correct explanation of A.

A is true, but R is false.

A is false, but R is true.

PART B

1. Define the second law of thermodynamics in terms of entropy.
2. Write the Gibbs-Helmholtz equation and explain its significance.
3. What is the entropy of a perfectly crystalline substance at absolute zero according to the third law of thermodynamics?
4. Mention the characteristics that differentiate d-block elements from non-transition elements.
5. Analyze the differences between reversible and irreversible processes in terms of entropy change.
6. Write the general reaction for the preparation of ethers using Williamson's synthesis.
7. What is the product of aldol condensation of acetaldehyde?
8. State Hess's law of constant heat summation.

9. What is the significance of resonance stabilization in the acidic nature of carboxylic acids?
10. Compare and contrast the Clemmensen and Wolff-Kishner reductions based on reaction conditions and substrate sensitivity.

PART C

1. Derive the Gibbs-Helmholtz equation and discuss its applications in thermodynamics
2. Describe the Carnot cycle and derive an expression for the efficiency of a Carnot engine.
3. Differentiate between the Gibbs free energy and Helmholtz free energy. How do they vary with temperature and pressure?
4. Compare the colour and magnetic properties of d-block elements with non-transition elements.
5. Describe the extraction process of vanadium and discuss its major industrial uses
6. Compare the structures, preparation, and uses of ethers and thioethers.
7. Analyze the mechanism for the aldol condensation and Cannizzaro reaction
8. Analyze the differences between Claisen condensation and Dieckmann condensation.
9. What is Zeisel's method? Explain how it is used to estimate the methoxy group in ethers.
10. Compare the reduction methods for aldehydes and ketones: Clemmensen, Wolff-Kishner, and Meerwein-Ponndorf-Verley

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. Y. Christabel Shaji

Department : Chemistry
Class : Elective Course I: Physics
Title of the Course : Chemistry for Biological Sciences - II
Semester : IV
Course Code : CU234EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU234EC1	4	-	-	-	3	4	60	25	75	100

Prerequisites: Chemistry for physical sciences -I

Learning Objectives

1. To know co-ordination Chemistry, Water Technology and catalysis
2. To understand Carbohydrates, Amino acids and electrochemistry

Course Outcomes

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology	PSO 1	K1
CO - 2	explain the preparation and property of carbohydrate, amino acids and nucleic acids.	PSO 2	K2
CO - 3	apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.	PSO 3	K3
CO - 4	analyze the various types of photochemical process, catalysis, determine the reaction rate and order of chemical reactions	PSO 5	K4
CO - 5	evaluate the nature of carbohydrates, reaction rates and electroplating metals	PSO 6	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 – Analyze, K5 - Evaluate

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Co-ordination Chemistry and Water Technology					
	1	Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature	2	K1(R)	Lecture method	Concept explanations

	2	Werner's theory - EAN rule - Pauling's theory – Postulates	3	K3(A)	Lecture using ppt	Slip test
	3	Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ - Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea)	3	K4(An)	Lecture using ppt	MCQ
	4	Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method	2	K4(An)	Group Discussion	Slip test
	5	Zeolite method-Purification techniques- BOD, COD.	2	K4(An)	Lecture using ppt	Short test
II	Carbohydrates and Amino acids					
	1	Carbohydrates: Classification, preparation and properties of glucose	2	K2(U)	Lecture using videos and ppt	Short summary
	2	Properties of fructose and sucrose. Discussion of open chain ring structures of glucose and fructose.	2	K2(U)	Lecture method	Class test
	3	Glucose –fructose interconversion. Properties of starch and cellulose.	3	K3(A)	Group discussion	MCQ
	4	Amino acids: Classification - preparation and properties of alanine	3	K2(U)	Lecture method	Short test
	5	Preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).	2	K4(An)	Lecture using ppt	Short summary
III	Electrochemistry					
	1	Galvanic cells - Standard hydrogen electrode - calomel electrode	2	K2(U)	Lecture using ppt	Concept explanations
	2	Standard electrode potentials - electrochemical series. Strong and weak electrolytes	3	K3(A)	Lecture method	Slip test

	3	Ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method	2	K4(An)	Lecture using ppt	Short summary
	4	Buffer solutions and its biological applications - electroplating - Nickel and chrome plating	3	K4(An)	Lecture using videos	Quiz
	5	Types of cells -fuel cells-corrosion and its prevention.	2	K4(An)	Seminar	Group discussion
IV	Kinetics and Catalysis					
	1	Order and molecularity. Integrated rate expression for I order reaction.	3	K2(U)	Lecture using videos and ppt	short summary
	2	II (2A Products) order reaction and Pseudo first order reaction	2	K3(A)	Lecture using problem solving method	Slip test
	3	Methods of determining order of a reaction – Half-life period.	3	K4(An)	Lecture using problem solving method	Quiz
	4	Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes.	2	K3(A)	Lecture using videos	class test
	5	Concept of energy of activation and Arrhenius equation.	2	K4(An)	Lecture method	Slip test
V	Photochemistry					
	1	Grothus-Draper's law and Stark-Einsteins law of photochemical equivalence	3	K2(U)	Lecture using videos and ppt	slip test
	2	photochemical combination of Hydrogen-chloride reaction.	2	K4(An)	Lecture using ppt	MCQ
	3	Phosphorescence, fluorescence and chemiluminescence	3	K3(A)	Lecture using videos and ppt	Slip test
	4	Photosensitization and photosynthesis (definition with examples).	2	K3(A)	Lecture using videos	Slip test

	5	Quantum yield	2	K3 (A)	Lecture method	Class test
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Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability and Entrepreneurship

Activities (Em): Demonstration of conductometric titrations

Assignment: (Mention Topic and Type)

Estimation of Hardness of water, BOD and COD

PART A

- The metal atom present in chlorophyll is _____
- The carbohydrate stored in animals is _____
- Among the following, in solution, which is a weak electrolyte?
a) HCl b) CH₃COONa c) CH₃COOH d) NaCl
- Energy of activation increases with _____
a) pressure b) temperature c) mass d) volume
- Photosynthesis takes place in the presence of _____

PART B

- How is BOD and COD of water is determined?
- Give the preparation and properties of glucose.
- Explain corrosion and its prevention
- Deduce the rate constant of second order reaction.
- Explain the photochemical combination of hydrogen and chlorine.

PART C

- Estimate the total amount of hardness present in water sample using EDTA method.
- How is fructose converted into glucose and glucose into fructose.
- Explain the following
(i) Standard hydrogen electrode
(ii) Conductometric titrations
- How will you determine the order of a reaction?
- Write notes on
(i) Phosphorescence
(ii) Fluorescence
(iii) Chemiluminescence

Course Instructor
Dr. M. Anitha Malbi

Head of the Department
Dr. M. Anitha Malbi

Department : Chemistry
Class : III B.Sc Chemistry
Title of the Course : Core VIII: Organic Chemistry - II
Semester : VI
Course Code : CC2061

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
CC2061	6	-	-	5	6	90	30	70	100

Objectives:

- To know the synthesis and structure of carbohydrates, alkaloids, terpenoids and dyes
- To understand the rearrangements, synthetic strategies and terminologies involved in organic synthesis and the role of reagents in organic synthesis.
- To study the basic principles of UV, IR and NMR spectroscopy and instrumentation.

Course Outcomes (COs)

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	understand the synthetic methodology, reagents and rearrangements in organic chemistry	PSO - 1	K2(U)
CO - 2	elucidate the structure of carbohydrates, alkaloids and terpenoids	PSO - 6	K6(C)
CO - 3	synthesize dyes and compounds of synthetic importance	PSO - 4	K3(Ap)
CO - 4	analyse the strategies and terminologies involved in organic synthesis leading to new products	PSO - 5	K4(An)
CO - 5	apply the spectral techniques in structural determination	PSO - 6	K3(Ap)

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	Carbohydrates					
	1	Carbohydrates: Definition - classification with suitable examples - classification of sugars as reducing and non-reducing sugars - stereochemistry of carbohydrates: D- and L-configurations - erythro and	3	K2(U)	Lecture with videos and ppt	Slip test and quiz

		threodiastereomers - anomers and epimers with suitable examples				
2		Monosaccharides: Classification of monosaccharides with suitable examples – glucose - properties of glucose - epimerisation of glucose - anomers of glucose and mutarotation - fructose and its properties	3	K4(An)	Group discussion	Oral test
3		Conversion of aldose to ketose and ketose to aldose - formation of osazone and glycosides - Fischer open structure and evidences for open structure - Haworth projection cyclic structures - pyranose and furanose and evidences for cyclic structures of glucose and fructose	3	K2(U)	Lecture with videos and ppt	Quiz and group discussion
4		Stepping up - Kiliani- Fischer synthesis and stepping down - Ruff degradation of monosaccharides	3	K3(Ap)	Lecture with chalk and talk	Slip test
5		Disaccharides: α - and β - glucosidic linkages with suitable examples - 1,4' and 1,5' linkages with suitable examples - Structure and properties of sucrose	3	K3(Ap)	Blended learning	Group discussion
6		Polysaccharides: Cellulose and starch - reactions and structure	3	K4(An)	Lecture with videos and ppt	Class test
II	Synthetic Methodology and Reagents					
1		Synthetic terminology - Disconnection, synthon, synthetic equivalent (SE), functional group interconversion (FGI), target molecule (TM)	3	K2(U)	Flipped classroom	Concept explanations and group discussion
2		Retro synthetic analysis - Linear, convergent and combinatorial syntheses	2	K2(U)	Lecture with illustrations	Slip test
3		Retrosynthesis of 4-methyl acetophenone, methylcyclohex-3-enecarboxylate, phenylethylbromide, 2-methylcyclopentene and 2-allyl phenol	3	K3(Ap)	Lecture with illustrations	Class test
4		Role of reagents in organic synthesis: DIBAL, NBS, DCC, trimethylsilyl chloride and methyl lithium - List of nucleophilic reagents and electrophilic reagents	5	K4(An)	Lecture with illustrations	Quiz and surprise test
5		Malonic ester and acetoacetic ester in the synthesis of monocarboxylic acids - dicarboxylic acids - α,β -unsaturated carboxylic acids and heterocyclic compounds	5	K4(An)	Lecture with illustrations	Quiz and slip test

III Natural Products and Dyes						
	1	Alkaloids: Definition - classification with suitable examples for each class - properties - structural determination - Hoffman exhaustive methylation	3	K2(U)	Blended learning	Concept explanations
	2	Sources, isolation, physiological activities and structural elucidation of conine, piperine and nicotine.	4	K4(An)	Lecture with illustrations	Slip test
	3	Terpenoids: Definition, classification, isoprene and special isoprene rule	2	K2(U)	Flipped classroom	Group discussion
	4	Sources, isolation, structural elucidation and uses of citral, geraniol and limonene	3	K4(An)	Lecture with illustrations	Short test and quiz
	5	Dyes: Theory of color and constitution - chromophore, auxochrome, classification according to application and structure.	3	K2(U)	Lecture with ppt and videos	Concept explanations and group discussion
	6	Preparation and uses of methyl orange, congo red, malachite green, phenolphthalein, fluorescein, indigotin and alizarin.	3	K3(Ap)	Lecture with illustrations	Class test
IV Rearrangements						
	1	Rearrangement to electron-deficient carbon - 1,2 shift - Wagner-Meerwein, pinacol-pinacolone, dienone-phenol, Wolff and benzil-benzilic acid rearrangements	5	K3(Ap)	Lecture with illustrations	Oral test
	2	Rearrangements from oxygen to ring carbon - Fries, Claisen and benzidine rearrangements	3	K3(Ap)	Lecture with illustrations	Slip test and quiz
	3	Rearrangement to electron-deficient nitrogen - Beckmann, Schmidt, Hofmann, Lossen and Curtius rearrangements.	5	K4(An)	Lecture with illustrations	Short test
	4	Rearrangement to electron-deficient oxygen: Baeyer-Villiger oxidation, Dakin reaction, cumenehydroperoxide-phenol rearrangements.	5	K4(An)	Lecture with illustrations	Quiz and slip test
V Spectroscopy						
	1	UV Spectroscopy: Electromagnetic spectrum - Types of electronic transitions - λ_{max} , chromophores and auxochromes. Bathochromic and hypsochromic shifts. Intensity of absorption - hyper chromic and hypo chromic shifts	3	K2(U)	Flipped classroom	Concept explanations and group discussion

2	Application of Woodward-Fieser rules for calculation of λ_{\max} for α , β unsaturated aldehydes, ketones, carboxylic acids and esters. Conjugated dienes - acyclic, homoannular and heteroannular, extended conjugated systems-aldehydes, ketones and dienes	4	K3(Ap)	Problem solving and group discussion	Group discussion and Assignment
3	IR Spectroscopy: Molecular vibrations and origin of IR spectra, IR absorptions- fingerprint region and its significance. H-bonding-inter and intramolecular hydrogen bonding	3	K2(U)	Lecture with ppt and videos	MCQ
4	Application in functional group analysis. IR spectrum of alkane, alkene, alkyne, alkyl halide, alcohols and carbonyl compounds	2	K3(Ap)	Lecture with ppt	Short test
5	NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it. Significance of number of peaks and peak area. Spin-spin coupling and coupling constant	3	K2(U)	Lecture with ppt and videos	Quiz and slip test
6	Interpretation of NMR spectra of simple compounds- ethyl alcohol, benzene, methyl chloride, benzaldehyde and mesitylene	3	K4(An)	Problem solving and group discussion	Group discussion

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability Activities (Em):

Synthetic terminology - Group discussion.

Calculation of λ_{\max} of organic compounds using Woodward-Fieser rule - Group discussion.

Interpretation of NMR spectra of simple compounds - Group discussion.

Assignment: (Mention Topic and Type)

1. Theory of colour and constitution - Assignment
2. Interpretation of λ_{\max} of organic compounds using Woodward-Fieser rule simple compounds – Assignment.

Sample questions

Part A

1. Pick out the reducing sugars from the following.
(a) D-glucose (b) D-Fructose (c) Sucrose (d) Cellulose
2. D-Glucose and D-Galactose are epimers. Say True or False.
3. Assertion: Synthons are idealized fragments resulting from a disconnection.
Reason: Synthons are derived from synthetic equivalents.
(a) Both A and R are false (b) Both A and R are true
(c) A is true but R is false (d) R is true but A is false
4. Identify the reagent used for the conversion of cyclohexene to 3-bromocyclohexene.
(a) DCC (b) Methyl lithium (c) NBS (d) DIBAL
5. Coniine on oxidation with zinc dust gives _____.

6. Draw the structure of fluorescein.

7. Match the following:

Rearrangement

Product

(a) Wolff rearrangement

(i) Ester

(b) Fries rearrangement

(ii) Amine

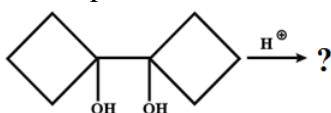
(c) Hofmann rearrangement

(iii) Ketene

(d) Baeyer-Villiger rearrangement

(iv) Hydroxy ketones

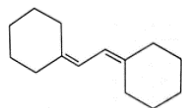
8. Propose the product of the following rearrangement:



9. Which of the following do not affect chemical shift?

(a) Inductive effect (b) Tautomerism (c) Resonance effect (d) Hydrogen bonding

10. Predict the λ_{\max} value of the following compound:



(a) 237 nm

(b) 245 nm

(c) 247 nm

(d) 240 nm

Part B

1. Define epimers and anomers with suitable examples.
2. Discuss any two chemical properties of glucose.
3. Describe the following retrosynthesis terminologies with examples:
 - (i) Target molecule
 - (ii) Synthons
 - (iii) Synthetic equivalents
 - (iv) Target molecule
4. Analyze the role of DIBAL and DCC reagents in organic synthesis.
5. Elucidate the structure of limonene.
6. Illustrate Hoffman exhaustive methylation with an example.
7. Predict the mechanism of cumenehydroperoxide-phenol rearrangement.
8. Mention any two applications of Wolff and Wagner-Meerwein rearrangements.
9. Draw the NMR spectrum of ethyl alcohol and methyl chloride
10. Describe the following terms with examples:
 - (i) Chromophore
 - (ii) Auxochrome
 - (iii) Bathochromic Shift
 - (iv) Hypsochromic Shift

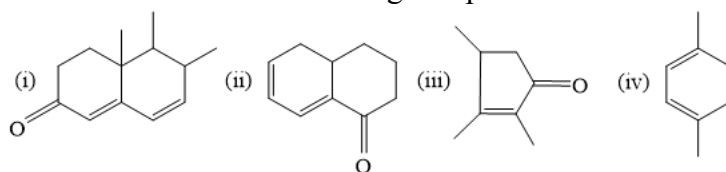
Part C

1. How will you convert aldose to ketose and ketose to aldose?
2. Discuss the Ruff degradation.
3. Predict the retrosynthesis of 4-methyl acetophenone and 2-allyl phenol.
4. Analyze the synthetic applications of malonic ester and acetoacetic ester for the synthesis of mono and di carboxylic acids.
5. Elucidate the structure of nicotine.
6. Deduce the preparation and uses of malachite green and phenolphthalein.
7. Compare the mechanism of Schmidt and Curtius rearrangements.
8. Predict the mechanism of the following rearrangements:

(i) Acetamide to methyl amine

(ii) Hydrazobenzene to benzidine

9. Calculate the λ_{max} for the following compounds:



10. Analyze the factors which affect the chemical shift in NMR spectroscopy.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. Sheeba Daniel

Department : **Chemistry**
Class : **III B.Sc Chemistry**
Title of the Course : **Inorganic Chemistry**
Semester : **VI**
Course Code : **CC2062**

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
CC2062	4	1	-	5	5	75	30	70	100

Objectives

- To understand the concepts and applications of nuclear reactions.
- To know the characteristics of solids and its applications.
- To gain knowledge about the development and uses of bioinorganic compounds.

Course Outcome

CO - No.	Upon completion of the course students will be able to	PSO	CL
CO - 1	understand the types of nuclear reactions and their applications	PSO – 1	U
CO - 2	differentiate natural and artificial radioactivity	PSO – 2	An
CO – 3	classify crystal systems and their structures	PSO – 1	An
CO – 4	predict the role of bioinorganic compounds in biological systems	PSO – 2	A
CO – 5	use the solid materials for specific purposes	PSO – 6	A

Teaching plan

Total Contact hours: 75(Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/E valuation
I	Nuclear Chemistry I					
	1	Introduction – composition of nucleus and nuclear forces – nuclear stability – mass defect – binding energy – packing fraction – N/P ratio	3	K2(U)	Lecture using models, chalk and talk	Slip test and concept explanations
	2	Magic numbers – nuclear models – liquid drop – Shell and collective model. Isotopes – detection and separation	3	K3(A)	Group discussion and problem solving	Problem solving

	3	Deviation of atomic weights from whole numbers – isobars, isotones and isomers	3	K3(A)	Lecture using chalk and talk, group discussion	Short test
	4	Radioactive decay and equilibrium – nuclear isomerism – internal conversion.	3	K2(U)	Lecture using chalk and talk	Slido and MCQ-Google forms
	5	Nuclear Q-value – threshold energy – cross sections, types of reactions Fission and fusion – modes of radioactive decay.	3	K3(A)	Lecture using chalk and talk, and problem solving	Group discussion and problem solving
II	Nuclear Chemistry II					
	1	Natural and induced radioactivity – radioactive decay – half-life period – radioactive displacement law– Average life period.	3	K2(U)	Lecture using chalk and talk	Short test
	2	Radioactive series – Radioactive techniques – Geiger Muller and ionization counters. Natural radioactivity Detection and measurement of radioactivity	3	K3(A)	Lecture using chalk and talk	Slip test
	3	Radioactive series including neptunium series – group displacement law – Rate of disintegration and half-life period- Artificial radioactivity – induced radioactivity	2	K2(U)	Lecture using chalk and talk	Short test and MCQ-Google forms
	4	Transmutation of elements- hazards of radiations – nuclear energy – nuclear reactors –fission products and fission yields – spallation Photonuclear and thermo nuclear reactions	4	K3(A)	Lecture using chalk and talk	Short test and quiz
	5	Energy source of the sun and stars – carbon dating – rock dating. Radioactive waste disposal – applications of nuclear science in agriculture, biology and medicine – Atomic power projects in India.	4	K3(A)	Lecture using chalk and talk	Test-Mentor menti
III	Solid State Chemistry					
	1	Amorphous and crystalline solids - Laws of crystallography – Elements of symmetry – Weiss and Miller indices – Crystal systems and Bravais lattices - derivation of Bragg's equation -	3	K2(U)	Lecture using chalk and talk	Concept explanations

	2	Ionic bonding – lattice energy – Born equation and its derivation, radius ratio rules – structures of some ionic crystals – Structure of solids – comparison of X-ray and Neutron diffraction –.	3	K2(U)	Lecture using chalk and talk, Group discussion	Slip test
	3	Crystal structure of NaCl – powder method - Electrical, Magnetic and optical properties of solids – band theory semiconductors – superconductors.	3	K3(A)	Lecture using powerpoint	Test-Nearpod
	4	Solid state electrolytes – Types of magnetic behavior, dia, para, ferro, antiferro and ferrimagnetism – Hysterisis	3	K4(An)	Lecture using chalk and talk , Seminar	Slip test and quiz
	5	Solid state lasers – inorganic phosphors – ferrites – crystal defects- Schotkydefect –Frenkel defect – metal excess defect – metal deficiency defect – f center	3	K2(U)	Lecture using chalk and talk	Concept explanations
IV	Bioinorganic Chemistry					
	1	Metal ions in biology- role of sodium - potassium- calcium – magnesium – copper - molybdenum and their vital role in the active site	4	K2(U)	Lecture using powerpoint	Slip test
	2	Metallo proteins – types and functions – metalloenzymes - structure and characteristic features of Vitamin B ₁₂	4	K2(U)	Lecture using chalk and talk	Slip test and quiz
	3	Biological functions of haemoglobin and myoglobin, – sodium potassium pump- cytochromes and ferredoxins,	3	K3(A)	Lecture using chalk and talk	Short test
	4	Metal complexes of copper and platinum as therapeutic agents - Biological nitrogen fixation, Photosynthesis: Photosystem-I	4	K2(U)	Lecture using chalk and talk	Group discussion
V	Material Chemistry					
	1	Ionic conductors – sodium, β - alumina, sodium-sulphur battery. Intercalation – layered compounds –	3	K2(U)	Lecture using chalk and talk	Slip test

5. The number of atoms contained within a face-centred cubic unit cell is -----.
 a) 2 b) 3 c) 4 d) 1
6. The Miller indices of crystal planes which cut through the crystal axes at (2a,3b, c) are -----
 a) (236) b) (326) c) (122) d) (221)
7. For the synthesis of collagen the metal required is -----.
 a) Copper b) Zinc c) Sodium d) Potassium
8. Hemoglobin transports -----from lungs to tissues.
9. Nano materials exhibit increased quantum sizes effect than the bulk form. Say true or false.
10. For tissue welding these are used as solders
 a) nano composites b) nano shells c) nano dots d) nano films.

Part - B

1. Compare shell model and liquid drop model of nucleus.
2. Differentiate between nuclear fission and nuclear fusion.
3. Radioactive isotopes follow different decay series. Prove this concept using examples.
4. Write notes on transmutation of elements.
5. Derive Bragg's equation.
6. Write notes on Weiss and Miller indices.
7. What is the role of sodium and calcium in the biological system?.
8. What are metallo proteins? Explain the different types.
9. Write the principles of nanotechnology.
10. Write notes on super conductors.

Part - C

1. Packing fraction helps in predicting nuclear stability. Prove this statement by giving evidences.
2. Radioactive isotopes follow different decay series. Prove this concept using examples.
3. List out the applications of nuclear science in the field of agriculture, biology and medicine.
4. Write notes on radioactive waste disposal.
5. Derive Born – Lande equation for lattice energy of an ionic crystal.
6. .i) Explain rock salt structure of NaCl.
 ii) Differentiate between extrinsic and intrinsic semiconductors.
7. Explain sodium potassium pump
8. List out the biological role of hemoglobin.
9. Explain the sol-gel method of preparing nano particles.
10. Give the applications of nanotechnology in medical and industrial field.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. R. Gladis Latha

Department : Chemistry
Class : III B.Sc Chemistry
Title of the Course : Core XI: Physical Chemistry
Semester : VI
Course Code : CC2063

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
CC2063	5	-	-	5	5	90	30	70	100

Objectives:

- To understand the theories of reaction rate, adsorption and catalysis
- To learn phase rule and phase equilibria
- To know the concepts of symmetry elements, symmetry operations and point groups.

Course Outcomes (COs)

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	understand the theories of reaction rate, adsorption and catalysis	PSO - 1	K2(U)
CO - 2	construct phase diagrams for one and two component systems	PSO - 3	K6(C)
CO - 3	recall colligative properties and their applications	PSO - 2	K1(R)
CO - 4	predict the point groups of molecules	PSO - 3	K5(E)
CO - 5	construct group multiplication table for simple molecules	PSO - 7	K6(C)

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	Chemical kinetics					
	1	Rate of reaction – expression of rate – factors influencing rate of reaction – order and molecularity - definition and examples – differences between order and molecularity–zero, first and second order reaction – definition- examples.	3	K1(R)	Lecture with videos and ppt	Slip test and quiz - Slido
	2	Derivation of rate constant and half life period. Methods of determining order of reaction –differential, integral, half-life and Ostwald’s isolation methods.	3	K2(U)	Group discussion	Quiz - Nearpod

	3	Temperature dependence of reaction rates (Arrhenius equation) – significance – temperature coefficient – energy of activation – effect of catalyst	3	K2(U)	Lecture with videos and ppt	Quiz – Slido and group discussion
	4	Calculation of energy of activation– theories of reaction rates – collision theory of bimolecular gaseous reactions, activated complex theory	3	K3(Ap)	Lecture with chalk and talk	Slip test
	5	Comparison of collision theory and activated complex theory. Lindeman’s theory of unimolecular reactions	3	K3(Ap)	Blended learning - Mentimeter	Group discussion and quiz - Mentimeter
II	Phase Equilibria					
	1	Concept of phase – components - degrees of freedom - definitions and examples, derivation of Gibb’s phase rule.	3	K1(R)	Flipped classroom - Nearpod	Oral test and group discussion - Nearpod
	2	Phase diagram for one component system – water and sulphur systems.	2	K2(U)	Lecture with chalk and talk	Slip test
	3	Two component system – reduced phase rule – simple eutectic system – lead-silver system – Pattinson’s process of de-silverisation of lead-freezing mixtures-KI-H ₂ O system.	3	K2(U)	Lecture with illustrations	Class test
	4	Formation of compounds with congruent melting point – zinc-magnesium system and FeCl ₃ -H ₂ O system.	2	K6(C)	Lecture with videos and ppt	Quiz - Kahoot
	5	Formation of compounds with incongruent melting points – Na ₂ SO ₄ - H ₂ O system.	2	K2(U)	Lecture with chalk and talk	Quiz- Mentimeter and slip test
	6	Solid-gas equilibria – CuSO ₄ -H ₂ O system. Efflorescence, deliquescence and hygroscopy.	3	K5(E)	Lecture with videos and ppt	Quiz - Kahoot
III	Catalysis and Adsorption					
	1	Catalysis- characteristics- different types - homogeneous, heterogeneous, acid-base catalysis and auto catalysis	3	K1(R)	Blended learning - Mentimeter	Group discussion
	2	Catalysis-theories of catalysis- intermediate compound formation theory and adsorption theory	3	K1(R)	Lecture with illustrations	Slip test

	3	Kinetics of enzyme catalysis – Michaelis-Menten equation - derivation – applications of catalysis.	2	K2(U)	Flipped classroom - Nearpod	Group discussion
	4	Adsorption – definition-physorption and chemisorption – differences - factors influencing adsorption of gases on solids	2	K5(E)	Lecture with chalk and talk	Short test and quiz - Mentimeter
	5	Adsorption isotherms –types - Freundlich and Langmuir monolayer adsorption isotherms,	2	K2(U)	Lecture with ppt and videos	Concept explanation and assignment - Google classroom
	6	Gibbs adsorption isotherm - BET theory of multilayer adsorption – applications of adsorption . Adsorption indicators.	3	K2(U)	Lecture with chalk and talk	Class test
IV	Solutions and Colligative Properties					
	1	Solutions of non-electrolytes – solutions of liquids in liquids – vapour pressure of non-ideal solutions - type I, type II and type III.	3	K1(R)	Lecture with chalk and talk	Oral test
	2	Vapour pressure - composition and boiling point - composition curves of completely miscible binary solutions - type I, type II and type III.	3	K2(U)	Lecture with illustrations	Slip test and quiz - Nearpod
	3	Theory of fractional, azeotropic and steam distillations. Solubility of partially miscible liquids - phenol-water system, triethylamine – water system and nicotine water system.	3	K6(C)	Lecture with ppt and videos	Short test
	4	Colligative properties – definition and examples. Osmotic pressure, Laws of osmotic pressure – van't Hoff theory of dilute solutions - isotonic solution.	2	K2(U)	Lecture with chalk and talk	Quiz – Mentimeter and slip test
	5	Elevation of boiling point - molal boiling point elevation constant or ebullioscopic constant - determination of molar mass from elevation of boiling point.	2	K1(R)	Lecture with ppt and videos	Quiz - Quizizz and slip test
	6	Depression of freezing point - molal freezing point depression constant or cryoscopic constant - determination of molar mass by depression	2	K6(C)	Lecture with chalk and talk	Quiz - Quizizz and slip test

		of freezing point. Abnormal results and van't Hoff factor.				
V	Group theory					
	1	Symmetry elements and symmetry operations – definition of identity (E), proper rotational axis (n) – mirror plane (σ) – inversion centre (i) and rotation reflection axis (S_n).	3	K1(R)	Flipped classroom - Nearpod	Group discussion
	2	Symmetry operations generated by symmetry elements- H_2O , NH_3 , BF_3 , $[PtCl_4]^{2-}$, H_2O_2 (cis and trans) and CH_4 as examples.	4	K2(U)	Problem solving and group discussion	Group discussion and assignment - Google classroom
	3	Matrix representation of symmetry operations. Comparison of molecular and crystallographic symmetry.	3	K2(U)	Lecture with ppt and videos	MCQ - Mentimeter
	4	Group postulates – abelian and cyclic groups – group multiplication table	2	K6(C)	Lecture with ppt	Short test
	5	Molecular point groups – Point group assignment to simple molecules like H_2 , HCl , CO , H_2O , NH_3 and CO_2 . Determination of point groups.	3	K6(C)	Lecture with ppt and videos	Quiz - Kahoot and slip test

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities (Em):

Temperature coefficient and energy of activation - Group discussion.

Catalysis and its characteristics - Group discussion.

Symmetry elements and symmetry operations - Group discussion.

Assignment: (Mention Topic and Type)

1. Formation of compounds with congruent melting point - Assignment
2. Depression of freezing point - molal freezing point depression constant or cryoscopic constant – Assignment.

Sample questions

Part A

1. The rate constant of zero-order reactions has the unit -----
 - a) s^{-1}
 - b) $mol\ L^{-1}\ s^{-1}$
 - c) $L^2\ mol^{-2}\ s^{-1}$
 - d) $L\ mol^{-1}\ s^{-1}$
2. When the rate of the reaction is equal to the rate constant, the order of the reaction is
 - a) zero order

- b) first order
 - c) second order
 - d) third order
3. Which of the following is the non-homogeneous system?
- (a). Salt solution
 - (b). Sugar solution
 - (c). Saturated solution of NaCl
 - (d). Glucose in water
4. The Gibb's phase rule states _____
- (a). $P+F=C+2$
 - (b). $P+F=C+1$
 - (c). $P+F=C-2$
 - (d). $P+F=C-1$
5. Which one of the following is an example of adsorption?
- (a) ammonia in contact with water
 - (b) anhydrous CaCl_2 with water
 - © silica gel in contact with water vapours
 - (d) all of these
6. Which of the following colloids are solvent hating?
- a) lyophilic
 - b) lyophobic
 - c) hydrophilic
 - d) none of these
7. With evaporation, the boiling point of a solution
- (a) Decreases
 - (b) Increases
 - (c) Becomes half
 - (d) Remains the same
8. Which of the following is not a colligative property?
- (a) Surface tension
 - (b) Osmotic pressure
 - (c) Vapour pressure depression
 - (d) Boiling point elevation
9. Matrix multiplication is a/an _____ property.
- a) Commutative
 - b) Associative
 - c) Additive
 - d) Disjunctive
10. In any group, the number of improper subgroups is 2 . Say True or False.

Part B

1. Write the differences between order and molecularity of a reaction.
2. Discuss the factors influencing the rate of the reaction.
3. Derive Gibb's phase rule .
4. Illustrate efflorescence and deliquescence.
5. Discuss the characteristics of catalysis.
6. Differentiate between physisorption and chemisorption.
7. Define osmotic pressure. Write the laws of osmotic pressure.
8. How will you determine the molar mass from elevation of boiling point?
9. Define identity and proper rotational axis.
10. Compare molecular and crystallographic symmetry.

Part C

1. Explain the methods of determining order of reaction.
2. Derive Arrhenius equation and write its significances.
3. Illustrate the phase diagram for water system.
4. Explain the lead-silver system with a neat phase diagram.
5. Derive Michaelis-Menten equation .
6. Discuss intermediate compound formation theory and adsorption theory.
7. Explain the solubility of partially miscible phenol-water system.
8. What is depression of freezing point? How will you determine the molar mass by depression of freezing point?
9. List the properties of group postulates. ii) Write notes on group multiplication table
10. Explain the symmetry elements of
 - a) CH_4
 - b) H_2O
 - c) BF_3

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. S. Ajith Sinthuja