

2021 REGULATIONS

SBS 4104	Basic Computing Lab (B.Sc., Chemistry, Physics, Maths, English)	L	T	P	Credits	Total Marks
		0	0	3	2	100

Course Objective

- Equip students with the fundamental knowledge of computer technologies.
- Provide an understanding of the role of computation can play in solving problems.
- Develop the student's understanding of the basic concepts of computer oriented programming and how to test their programs in using an integrated approach.
- Engage learning core concepts through a hands-on practical approach to enable students to apply their skills to different scenarios.

a. Word Processing

- Change the layout of the page as given below.
Page size: A4 (8.27" x 11.69")
Page orientation: Landscape
- Change the page margins as follows:
Top: 1.25" Bottom: 1.25"
Right: 1.25" Left: 1.25"
- Create drop cap for first paragraph. Drop it 2 lines down with 'Algerian' font and there should be 0.4" space between dropped character and paragraph.
- Present second paragraph in three columns with a line between each column. The first and third columns will be 1" wide and the second column is 4"
- Apply gray color background and double line border around third paragraph. Border lines should be of blue color and 1½ thick.
- Justify third paragraph and apply 2" indent from left and right.
- Enter "History of Computer Technology" as header and enter footnote for the underlined word of third paragraph.
- 8. Create a custom watermark, cross referencing in word, a user entry form**
- Create a main document for the invitation of a birthday party.

b. Spreadsheet

- Create an Excel Formula for the given string format using String Functions. Input: I Love India

Output: India 5

- In a Table, we have students name and their Marks in Science, social & maths subjects. Find the top student in each subject based on their mark (using Excel Formula)

Name	Subject	Marks
Raja	Science	75
Bala	Maths	45
Umar	Social	57
Raja	Maths	87
...		

- Count the total number of occurrences of "A" in the following table using Excel Formula – (Should be Generic)
- Create a Formula to count the cells that having values except blank cells
- Create a Formula to calculate the EB bill with the given tariff 1 – 100 : Rs. 75

101–200 : Rs. 1.10

201–300 : Rs. 2.00

301–500 : Rs. 3.00

501 & above : Rs. 5.00

- Create a formula to calculate the classification of result
 - Below 40 : Fail
 - 40 – 50 : 3rd Class
 - 51–60 : 2nd Class
 - 61–70 : 1st class
 - Above 70 : Distinction
- With the given chart,

	A	B	C	D	E
1	Master List				
2	Sales Person ID	Sales Person Name	Sales Person Revenue	Quota	Met Quota?
3	1	John	\$ 232,103.00	\$ 500,000.00	Did Not Meet Quota
4	2	Joe	\$ 835,477.00	\$ 500,000.00	Met Quota
5	3	Jen	\$ 116,371.00	\$ 500,000.00	Did Not Meet Quota
6	4	Frank	\$ 393,841.00	\$ 500,000.00	Did Not Meet Quota
7	5	Mark	\$ 989,303.00	\$ 500,000.00	Met Quota
8	6	Amanda	\$ 641,883.00	\$ 500,000.00	Met Quota
9	7	Erik	\$ 525,894.00	\$ 500,000.00	Met Quota
10	8	Mike	\$ 732,195.00	\$ 500,000.00	Met Quota
11	9	Matt	\$ 513,372.00	\$ 500,000.00	Met Quota
12	10	Josh	\$ 961,561.00	\$ 500,000.00	Met Quota
13	11	Shea	\$ 235,652.00	\$ 500,000.00	Did Not Meet Quota

Find the average of Sales person revenue who are all met the quota and who are all not met.

8. From the given table,

Forename	Middle Name 1	Middle Name 2	Surname
Raja	Ravi	Chandar	Dilak

Print the **Full name** using excel formula

9. Convert float values into integer values

10. Find the factorial of given value 11.

SESSION_NO	ROUND1	ROUND2	ROUND3	TOTAL/ 300	PERCENTAGE	GRADE
SS1	56	46	65			
SS2	78	56	67			
SS3	98	85	81			
SS4	71	77	68			

Criteria to find GRADE

PERCENTAGE >= 80 ----- ☐ GRADE – A

PERCENTAGE between 79 and 60 (both are inclusive) ----- ☐

GRADE – B

PERCENTAGE between 59 and 50 (both are inclusive) ----- ☐

GRADE – C

Otherwise ----- ☐ GRADE – F

(a) Find out TOTAL and PERCENTAGE of all sessions using function or formula. (1)

(b) Find out GRADE using above specified criteria of all sessions. (1)

(c) Using SESSION_NO and PERCENTAGE create a line chart. (2)

AAAA College								
Mark Sheet								
ID.No	Name	Physics	Chemistry	Biology	English	Total	Average	Rank
1A001	Lavanya	72	65	57	82			
1A002	Rithika	78	64	54	56			
1A003	Ram	56	63	72	54			
1A004	Ritesh	46	48	64	52			
1A005	Pranesh	48	65	56	65			
1A006	Pavithra	57	53	63	62			
1A007	Sara	65	54	53	51			

a. Use the relevant formula to calculate the total marks of "Lavanya" (ID No. 1A001) and copy the formula to the relevant cells.

b. Use the relevant formula to calculate the average marks of "Lavanya" (ID No. 1A001) and copy the formula to the relevant cells.

c. Use conditional formatting to change the color of the cells of which the average mark is more than 60, into green

d. Create a Pie chart for the student marks in the given table

C. Presentation Tool

1. Add notes to power point presentation
2. Create a power point application to play a video
 - a. Play a video fullscreen
 - b. Hide a video when not playing
 - c. Loop a video
3. Create a dynamic presentation in Powerpoint
 - a. To add an animation to text or an object
 - b. Apply sound effects to animated text and objects
 - c. Create a motion path to text and objects
4. Creation of PowerPoint presentation about "Computer generation".
5. Create maximum 5 slides.(1)
6. Use different layouts and background design.(1)
7. Add bulleted list with animation effects.(1)
8. Set different slide transition effects.(1)

d. Usage of Google tools in education

Google
docs
Google
Forms
Google
Spread
sheets
Google
Blogger

SCYA 1103	GENERAL CHEMISTRY-I	L	T	P	Credits	Total Marks
		3	1	0	3	100

COURSE OBJECTIVES

- To understand the basic concepts of atomic structure and Quantum mechanics.
- To study the basic concepts of ionic bonding.
- To provide knowledge in covalent bonding for formation of MO theory.
- To understand the nomenclature of organic molecules.
- To study the postulates of gas laws and its applications

UNIT 1 ATOMIC STRUCTURE AND BASIC QUANTUM MECHANICS**9 Hrs**

Rutherford's and Bohr's model an atom- Bohr's theory and origin of hydrogen spectrum-Electromagnetic radiation- definitions for λ , ν and velocity-Dualism of light -Particle nature of radiation- black body radiation and Planck's quantum theory, photoelectric effect and Compton effect of matter- De Broglie hypothesis and Davisson and Germer experiment. Heisenberg's uncertainty principle. Schrodinger wave equation (Derivation not needed). Physical significance of Ψ and Ψ^2 .

UNIT 2 IONIC BOND**9 Hrs.**

General characteristic of ionic bonding, Energy considerations in ionic bonding, Lattice energy and Solvation energy and their importance in the context of stability and solubility of ionic compounds.Statement of Born-Landé equation for calculation of Lattice energy, Born – Haber cycle and its applications, polarizing power and polarisability.Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

UNIT 3 COVALENT BOND**9 Hrs.**

Valence Bond theory-arrangement of electrons in molecules, Hybridization and geometry. VSEPR model- BeF_2 , BF_3 , PF_5 , SF_6 , IF_7 , H_2O , NH_3 , IF_5 , XeF_2 , XeF_4 , XeF_6 and XeOF_4 .Effect of bonding and nonbonding electrons on the structure of molecules.MO theory: LCAO method-criteria of orbital overlap, types of molecular orbitals, qualitative MO energy level diagram of homo and hetero diatomic molecules, and their magnetic properties, bond length, bond energy, bond order and stability of molecules.

UNIT 4 CLASSIFICATION AND PROPERTIES OF ORGANIC COMPOUNDS**9 Hrs.**

IUPAC Nomenclature (Monofunctional and polyfunctional) –Shapes of simple molecules - Bond energy, bond length and bond angle - Bond polarity – dipole moment –Bond dissociation energy - Isomerism – Structural and Stereoisomerism – types of isomerism with suitable examples - Concept of hybridization - Structure of organic molecules based on sp^3 , sp^2 and sp hybridization – Energy requirements of a reaction – Activation Energy – Transition state – Intermediate – Effect of catalyst on energy of activation.

UNIT 5 KINETIC THEORY AND GASEOUS STATE**9 Hrs**

Postulates of kinetic theory of gases-derivation of gas laws from the kinetic gas equation. Kinetic energy and temperature-Degrees of freedom of a molecule-Principle of equipartition of energy: Average translational kinetic energy and its calculation-Maxwell's distribution of molecular velocities (no derivation)-mean, root mean square and most probable velocity-Collision diameter, collision number, collision frequency, mean free path. Transport properties: viscosity, thermal conductivity, diffusion.

Max. 45 Hrs.**COURSE OUTCOMES**

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

- CO1: Apply the laws of radiation and principles of quantum mechanics to the particle matter
- CO2: Assess the stability of ionic bonding in molecules
- CO3: Examine the hybridization and geometry of chemical bonding in molecules
- CO4: Apply the concept of bond energies to the structure and formation of organic compounds
- CO5: Analyze the postulates of kinetic theory of gases for the determination of kinetic energy and molecular velocities
- CO6: Evaluate the basic concept of chemistry to real world applications

TEXT / REFERENCE BOOKS

1. R. K. Prasad, Quantum Chemistry, New Age International Publishers, Revised 7th Edition, 2020.
2. Selected topics in inorganic chemistry, [R D Madan](#), [G D Tuli](#) & [Wahid U Malik](#), S.Chand publication, 1976.
3. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th ed., Prentice-Hall of India Limited, New Delhi, 1992.
4. Bahl B.S. and ArunBahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).
5. S. H. Pine, Organic Chemistry, 5th ed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
6. B. R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co. 23rd edition, 1993.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each-No choice**20****Marks****PART B:** 2 Questions from each unit with internal choice, each carrying 16 marks**80****Marks**

SCYA 2102	VOLUMETRIC ANALYSIS	L	T	P	Credits	Total Marks
		0	0	3	2	100

COURSE OBJECTIVES

- To bridge the conceptual ideas with practical experiments.
- To promote analytical skills in volumetric analysis.

VOLUMETRIC ANALYSIS:

1. Laboratory safety and Hygiene
2. Preparations of Reagents and Standard Solutions
3. Calibration of volumetric apparatus: Burette, pipette and standard flasks.
4. Determination of Mean, Standard Deviation, Co-efficient of Variations of given sample.
5. Acid – base titrations:
 - a. Estimation of HCl.
 - b. Estimation of oxalic acid.
6. Redox titrations:
 - a. Estimation of Ferrous ammonium sulphates (Permanganometry).
 - b. Estimation of KMnO_4 (Iodometry).
 - c. Estimation of Copper (Iodometry).
7. Complexometric titration:
 - a. Estimation of Calcium using EDTA.
 - b. Estimation of Magnesium using EDTA

COURSE OUTCOMES

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

CO1: Apply safety protocols in chemistry laboratory

CO 2: Interpret the statistical parameters in quantitative analysis

CO3: Quantitative skills in volumetric analysis..

TEXT / REFERENCE BOOKS

- 1). S. Sundaram and K. Raghavan, Practical Chemistry, S. Viswanathan Co. Pvt., 1996.
- 2). N. S. Ganapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S.Viswanathan Co. Pvt., 2002.
3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th ed., Pearson Education, 2005.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 50
Duration: 2 Hrs.

Exam

CAE	Evaluation of Regular Lab class	15 Marks	25 Marks
ESE	Model practical exam	10 Marks	
	End Semester Practical exam		25 Marks

SCYA 1201	GENERAL CHEMISTRY-II	L	T	P	Credits
		3	1	0	4

COURSE OBJECTIVES

- To understand the properties of liquid state and liquid crystal states.
- To study the structure of atoms and periodic properties of elements
- To understand the structure and reactivity of organic molecules
- To learn various methods of preparation and reactions of hydrocarbons
- To learn the classification of solids and conduction in semiconductors and superconductors.

UNIT 1 LIQUID STATES**9 Hrs**

Intermolecular forces in liquids- vapour pressure of a liquid- surface tension of a liquid- surface active agents-capillary rise method for determining surface tension-Parachor- viscosity-Poiseuille's equation-molar refractivity-optical exaltation. Liquid Crystals: Types of liquid crystals –Applications of liquid crystals.

UNIT 2 PERIODIC TABLE AND PERIODIC PROPERTIES**9 Hrs**

.Periodicity-Periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number.Horizontal, vertical and diagonal relationships in the periodic table.Properties of atoms- Size of atoms and ions-atomic radii, ionic radii, covalent radii, trend in ionic radii, ionization potential, electron affinity, electronegativity - Simple problems.-Pauling, Mulliken-Jaffe, Allred-Rochow definitions, oxidation states and variable valency, isoelectronic relationship, inert-pair effect. Atomic, molecular and equivalent weights, Avagadro's principle and mass-volume relationship.

UNIT 3 STRUCTURE AND REACTIVITY OF ORGANIC COMPOUNDS**9 Hrs**

Types of organic reactions - Cleavage of bonds - Homolytic and Heterolytic bond fission -Reactive intermediates - carbocation, carbanion, and free radicals - Structure, shape, stability and reactivity -Carbenes, nitrenes and arynes - Factors affecting stability of the reaction intermediates - Electron displacement effects - Inductive effect, electromeric, mesomeric, resonance, hyperconjugation- Hydrogen bonding - Tautomerism – Keto-enol tautomerism

UNIT 4 ALKANES AND CYCLOALKANES**9 Hrs**

Structure – Nomenclature – General methods of preparing alkanes - Preparation by Wurtz reaction and Kolbe's method – Physical and Chemical properties – Substitution: Halogenation, nitration, sulphonation, oxidation, pyrolysis, aromatization with mechanism - Cycloalkanes – Nomenclature – Preparation by Wurtz reaction, Dieckmann's ring closure, Clemmensen's reduction - Physical and Chemical Properties - Mechanism of substitution and ring opening reactions – Baeyer's strain theory.

UNIT 5 SOLID STATES**9 Hrs**

Classification of solids- Isotropic and anisotropic crystals- elements of symmetry basic seven crystal systems- laws of crystallography- representation of planes miller indices, space lattice and unit cell. Semiconductor: Band theory of solids- Intrinsic and Extrinsic semiconductors-n-type and p-type conductors-doping of semiconductors. Superconductors: Definition-characteristics-copper and iron-based superconductors-applications of superconductors.

Max. 45 Hrs**COURSE OUTCOMES**

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

CO1: Examine the properties of liquid state and liquid crystal for the application in surface active agents and LCD displays

CO2: Analyze the periodic properties of elements in periodic table

CO3: Assess the relationship between the structure and reactivity of organic molecules

CO4: Apply the substitution and ring opening mechanism to the alkane and cycloalkane reactions

CO5: Apply the principles of band theory to the conduction mechanism in solids and superconductors

CO6: Evaluate the basic concept of chemistry to real world applications

TEXT / REFERENCE BOOKS

1. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007.
2. Selected topics in inorganic chemistry, R D Madan, G D Tuli & Wahid U Malik, S.Chand publication, 1976.
3. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th ed., Prentice-Hall of India Limited, New Delhi, 1992.
4. Bahl B.S. and ArunBahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).
5. S. H. Pine, Organic Chemistry, 5th ed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
6. J. March and M Smith, Advanced Organic Chemistry, 5th ed., John-Wiley and sons, 2001.
7. B. R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chandand Co. 23rd edition, 1993.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 Marks each-No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 16 Marks.**80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

2017 REGULATIONS

SCY 1314	INORGANIC CHEMISTRY II	L	T	P	C	Max. Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To learn the general characteristics and properties of halogens and interhalogen compounds.
- To explain the preparation, properties and extraction of lanthanides and actinides.
- To understand the importance of inorganic polymers based on phosphazines, nitrides and carboranes.
- To elaborate on the fundamental aspects of nuclear reactions, types of nuclear reactions and the measurement of radioactivity with the help of different types of counters.
- To learn the properties and uses of solid state systems with close packing arrangements along with their imperfections.

UNIT 1 HALOGENS AND INTERHALOGENS**12 Hrs.**

Group-17 (halogens): group discussion, anomalous behavior of F, ionic-, covalent-, bridging halides, reactivity of halogens, reduction of halogens by thiosulfate and application to iodo/iodimetry. Oxides and oxoacids of halogens, strength of oxoacids. Interhalogen compounds: ClF, ICl; ClF₃, BrF₃, IF₃; ClF₅, BrF₅, IF₅ with structure-VSEPR Model.

UNIT 2 'f' BLOCK ELEMENTS**12 Hrs.**

Lanthanides- Properties of lanthanides. Electronic configuration – oxidation states – ionic radii, lanthanide contraction. Colour and magnetic properties. Extraction of lanthanides. Uses of lanthanides. Actinides: Sources of actinides – preparation of transuranic elements - Electronic configuration – oxidation states – ionic radii – Colour of ions – comparison with lanthanides. Extraction of thorium and Uranium.

UNIT 3 INORGANIC POLYMERS**12 Hrs.**

Properties of inorganic polymers, glass transition temperature, poly phosphonitric chlorides, poly di-alkoxy phosphazines, polymeric sulphur and sulphur nitrides, chalcogenide glasses, poly carboranes, polysiloxanes, Silicon rubber and resins.

UNIT 4 NUCLEAR CHEMISTRY**12 Hrs.**

Fundamental particles of nucleus, concept of nuclides, representation of nuclides, unit of radioactivity, half- life period, radioactive equilibrium, radioactive displacement law, radioactive series, Measurement of radioactivity-ionization chamber, Geiger counter, scintillation counters, isotopes, isobars, isotones, nuclear forces, nuclear stability, structure of nucleus(shell and liquid drop model), packing fractions, mass defect, binding energy, Q- values, artificial transmutations, nuclear reactions, spallation, fission, fusion, breeder reaction, radio isotopes and applications of radio isotopes.

UNIT 5 STRUCTURE OF SOLIDS**12 Hrs.**

Solid state- crystalline and amorphous solids-structure and properties- laws of crystallography, Miller indices - simple cube, body centered cube and face centered cube - structure of NaCl and CsCl, diamond and graphite. Symmetry in crystals - crystal systems - crystal lattice - lattice planes and their designation - assignment of atoms/ions per unit cell in a cubic lattice - diffraction of X-rays by crystals - Bragg equation - structures of NaCl and CsCl - Avogadro number from cubic lattice dimension - closest packing - packing in ionic solids.

Max.60 Hrs.**COURSE OUTCOMES**

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

CO1: Explain the characteristics and mechanism involved in the reactions of halogen and interhalogen compounds.

CO2: Discuss the preparation, properties and extraction methods for lanthanides and actinides.

CO3: Understand the properties, importance of inorganic polymers and their phase transitions.

CO4: Analyze the different types of polymers starting from various sources.

CO5: Understand different types of nuclear reactions and determination of radioactivity using counters.

CO6: Identify the importance of solid state packing and to understand the imperfections in packing of solids.

TEXT / REFERENCE BOOKS

1. Advanced Inorganic Chemistry, F.A. Cotton and G. Wilkinson, Wiley Eastern Private Limited 1992
2. Selected topics in inorganic chemistry, R D Madan, G D Tuli & Wahid U Malik, S.Chand publication, 1976
3. Inorganic Chemistry: Principles of Structure and Reactivity, J.E. Huheey, E.A. Keiter and R.I.Keiter, Addison-Wiley Publication Company, 1993.
4. Inorganic Chemistry, D.F. Shriver, P.W. Atkins, C.H. Longford, Oxford University Press, 1996

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 Questions of 2 Marks each-No choice****20 Marks****PART B : 2 Questions from each unit of internal choice, each carrying 16 Marks.****80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 1315	ORGANIC CHEMISTRY II	L	T	P	C	Max. Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To discuss the concept of organo-nitrogen compounds.
- To understand the chemistry of heterocyclic compounds containing O, N, S.
- To understand the synthesis, properties and reactivity of carboxylic acids.
- To develop the practice of learning molecular rearrangements along with their mechanism.
- To discuss the importance of active methylene groups in organic synthesis.

UNIT 1 CARBOXYLIC ACIDS AND THEIR DERIVATIVES**12 Hrs.**

Structure and nomenclature - General methods of preparation of carboxylic acids – acidity – Effect of substituents on acidity – Physical and Chemical properties – Hell-Volhard-Zelinsky Reaction - Dicarboxylic acids - oxalic, malonic succinic, glutaric, adipic, phthalic, acrylic, crotonic and cinnamic acids – Stereospecific addition to maleic and fumaric acids – Derivatives of carboxylic acids – Acid halides, esters, anhydrides and amides – Preparation and Properties – Relative reactivity - Acid and alkaline hydrolysis of esters – trans-esterification.

UNIT 2 ACTIVE METHYLENE COMPOUNDS**12 Hrs.**

Preparation of malonic ester, ethyl acetoacetate and cyanoacetic ester – Physical and Chemical properties – Tautomerism in ethyl acetoacetate - Synthetic applications – preparation of synthetically important compounds from active methylene compounds - Michael addition - synthetic uses.

UNIT 3 CHEMISTRY OF NITROGEN CONTAINING COMPOUNDS**12 Hrs.**

Amines – Structure, nomenclature and classification - Methods of preparation of primary, secondary and tertiary amines - Physical and chemical properties – Basicity of amines, effect of substituents on basicity of aromatic amines – Quaternary ammonium salts – Hinsberg test – Carbylamine test, Schotten-Baumann reaction. Nitro compounds – Structure - Aliphatic and Aromatic nitro compounds – Methods of preparation - Physical and Chemical Properties – Substitution of aromatic nitro compounds. Diazo compounds- Diazotisation and its mechanism. Cyanides and isocyanides – Structure, preparation and properties.

UNIT 4 MOLECULAR REARRANGEMENTS**12 Hrs.**

Types of rearrangement (nucleophilic and electrophilic) - Classification as anionotropic, cationotropic, free radical, inter and intramolecular - Mechanism and Stereochemical aspects of Pinacol-pinacolone rearrangement, Beckmann, Hoffmann, Curtius and Benzilic acid rearrangements – Benzidine, Lossen and Schmidt rearrangements - Claisen rearrangement (sigmatropic-evidence for intramolecular nature and allylic carbon attachment) – para Claisen, Cope and oxy Cope rearrangements, Wagner-Meerwein and Fries rearrangement.

UNIT 5 HETEROCYCLIC COMPOUNDS**12 Hrs.**

Nomenclature - Five membered rings - Preparation of pyrrole, furan and thiophene – Molecular orbital picture – Physical and Chemical properties – Electrophilic and nucleophilic substitution mechanism – Oxidation and reduction – Six membered rings – Pyridine and Quinoline– Preparation and properties - Skraup synthesis – Bischler Napieralski synthesis – Preparation and properties of Indole.

Max. 60 Hrs.**COURSE OUTCOMES**

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

- CO1: Explain the synthesis and reactivity of carboxylic acids.
- CO2: Discuss the general methods of preparation of active methylene groups and its applications.
- CO3: Determine the chemistry of amines and nitro compounds with its reactivity.
- CO4: Discuss the mechanism of various electrophilic rearrangements.
- CO5: Discuss the mechanism of various nucleophilic rearrangements.
- CO6: Construct the preparation and properties of various heterocyclic compounds.

TEXT / REFERENCE BOOKS

- R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th ed., Prentice-Hall of India Limited, New Delhi, 1992.
- Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., 1997.
- V. K. Ahluwalia, Organic Reaction Mechanism, Ane Books Pvt. Ltd, 2007.
- I. L. Finar, Organic Chemistry, Vol-1, 6th ed., Pearson Education Asia. 2004.
- I. L. Finar, Organic Chemistry, Vol-2, 6th ed., Pearson Education Asia. 2004.
- J. March and M Smith, Advanced Organic Chemistry, 5th ed., John-Wiley and sons, 2001.
- O. P. Agarwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House, 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 Questions of 2 Marks each-No choice****20 Marks****PART B : 2 Questions from each unit of internal choice, each carrying 16 Marks.****80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 1316	PHYSICAL CHEMISTRY-II	L	T	P	C	Max. Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To study the second and third laws of thermodynamics and their applications
- To understand the concepts and applications of electromotive force
- To learn the kinetics and mechanisms of chemical reactions
- To understand about adsorption, homogeneous and heterogeneous catalysis
- To study the laws and kinetics of photochemical reactions

UNIT 1 THERMODYNAMICS-II**12 Hrs.**

Need for the II law – Statements of the second law – Spontaneous process – Carnot's cycle – Efficiency – Carnot's theorem (statement only) – Concept of entropy – Definition – Entropy of an ideal gas – Entropy changes in cyclic, reversible and irreversible processes and physical transformations – Calculation of entropy changes with changes in T, V, P and entropy of mixing – Gibbs free energy – Helmholtz free energy: their variations with temperature, pressure and volume – Criteria for spontaneity – Gibbs-Helmholtz equations – derivation and applications – Chemical potential – Gibbs-Duhem equation – Effect of temperature and pressure on chemical potential – Chemical potential in system of ideal gases – Duhem-Margules equation – Clausius-Clapeyron equation – Derivation and uses – Nernst heat theorem – Third law of thermodynamics (statement only) – Fugacity (Definition), activity and activity coefficient.

UNIT 2 ELECTROCHEMISTRY-II**12 Hrs.**

Galvanic cells – Reversible and irreversible cells – Western Cadmium Standard cell – Emf and its measurements – Relation between free energy and EMF: Gibbs-Helmholtz equation – Thermodynamics of a cell reaction – Nernst equation of electrode reaction – Types of reversible electrodes – Single and standard electrode potential – Reference electrode – SHE – Electrochemical series and its significance – Concentration cell with and without transference – Liquid junction potential – Applications of EMF measurements – Determination of i) Valency of ions, ii) Solubility product, iii) pH using hydrogen, quinhydrone and glass electrodes – Potentiometric titration.

UNIT 3 CHEMICAL KINETICS-II**12 Hrs.**

Effect of temperature on the rate of reactions – Concept of activation energy: Arrhenius equation – Collision theory of bimolecular and unimolecular reactions: Lindemann hypothesis – Theory of absolute reaction rates (ARRT) – Parallel, Consecutive, opposing (No derivation) – Chain reactions: $H_2 - Br_2$ reaction (steps only. No kinetics required).

UNIT 4 SURFACE CHEMISTRY AND CATALYSIS**12 Hrs.**

Adsorption – Physisorption and chemisorption – Adsorption of gases by solids – Freundlich adsorption isotherm – Langmuir adsorption isotherm – Limitation of Langmuir theory – BET equation (no derivation) – Applications of adsorption – Homogeneous catalysis – Acid-base catalysis – Enzyme catalysis – Michaelis-Menten equation – Heterogeneous catalysis – Mechanism of unimolecular reactions.

UNIT 5 PHYSICAL PHOTOCHEMISTRY**12 Hrs.**

Photochemical reactions – Lambert's law – Beer's law – Grotthuss-Draper law – Quantum efficiency – Quantum yield – Primary and secondary process – Dissociation of HI – Kinetics of Hydrogen-bromine reaction – photosensitization – Chemiluminescence – Phosphorescence.

Max. 60 Hrs.**COURSE OUTCOMES**

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

- CO1: Understand the spontaneity and learn the derivations of various thermodynamic functions.
- CO2: Explain the applications of electrode potential and electromotive force.
- CO3: Interpret theories of reaction rates.
- CO4: Understand and relate unimolecular and multimolecular layer adsorption.
- CO5: Develop the knowledge of the different types of catalysis.
- CO6: Learn the laws of kinetics in photochemical reactions and importance of photochemical processes.

TEXT/REFERENCE BOOKS

1. B. R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co. 23rd edition, 1993.
2. ArunBahl, B. S. Bahl and G. D. Tuli, Essentials of Physical Chemistry, S. Chand publishing, 2012.
3. P.W. Atkins, Physical Chemistry, 7th Ed., Oxford university press, 2001.
4. Glasston & Lewis, Physical Chemistry, 2nd Edition, McMillan publishers, 1973.
5. A.S. Negi and S. C. Anand, A Textbook of Physical Chemistry, New Age International, 2004.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 Marks each-No choice**PART B:** 2 Questions from each unit of internal choice, each carrying 16 Marks.

(Out of 100 Marks, maximum of 10% problems may be asked.)

Exam Duration: 3 Hrs.**20 Marks****80 Marks**

SCY 1620	SYNTHETIC ORGANIC CHEMISTRY	L	T	P	C	Max. Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To learn the importance of oxidizing agents in organic reaction.
- To understand the significance of reducing agents in organic chemical reactions.
- To recognize the importance of organometallic compounds in organic reactions.
- To impart an insight into modern methodologies used in synthesis of organic compounds.
- To emphasize on chemical reactions involving the formation of cyclic transition structures.

UNIT 1 ORGANIC REAGENTS- I**12 Hrs.**

Introduction to Organic Reagents - Types of Reagents - Oxidation Reagents – DDQ - SeO₂ - KMnO₄ - OsO₄ - Epoxidation of Olefins - Jones Reagent - Oppenauer Oxidation - HIO₄.

UNIT 2 ORGANIC REAGENTS-II**12 Hrs.**

Reducing Agents - Hydride ion transfer mechanism - Electron Transfer mechanism – LAH - NaBH₄ - Electrophilic Reducing Agents - Allanes and Boranes. Hydroboration - Dissolving metal reduction - Birch Reduction - Clemmensen Reduction - Wolf-Kishner Reduction - Lindlars Reagent.

UNIT 3 ORGANIC REAGENTS-III**12 Hrs.**

Introduction to organo-metallic reagents - Grignard reagent, Gilman's reagent – LDA - 1, 3 dithianes - Wittig Reagent - Peterson olefination.

UNIT 4 GREEN CHEMISTRY**12 Hrs.**

Need - principles - planning of green synthesis - examples of green reactions - Importance and experimental conditions required – Green reactions in condensation, oxidation, reduction, rearrangement and addition reactions - Microwave assisted reactions, solid state synthesis and ionic liquid reaction.

UNIT 5 INTRODUCTION TO PERICYCLIC REACTIONS**12 Hrs.**

Pericyclic reactions – Introduction, Definition and classification – Electrocyclic, cycloaddition, sigmatropic and cheletropic reactions – Thermal and Photochemical approach – Diels Alder reaction – Frontier Molecular Orbital approach – Woodward-Hoffmann's rules

Max. 60 Hrs.**COURSE OUTCOMES**

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

CO1: Interpret the products in organic chemical reactions involving oxidizing reagents.

CO2: Solve the chemical reactions involving reducing agents.

CO3: Predict the products formed in organic chemical reactions catalyzed by organometallic reagents.

CO4: Analyze the methodologies involved in Green chemistry.

CO5: Propose a strategic plan for basic chemical reactions based on Green chemistry principles.

CO6: Design and predict the reaction mechanism in electrocyclic, cycloaddition, sigmatropic and cheletropic reactions.

TEXT / REFERENCE BOOKS

1. Clayden, Greeves, Warren and Wothers., Organic chemistry, Oxford University, 2001.
2. J. March's Advanced Organic Chemistry Reaction, Mechanisms and Structure, Wiley 2007.
3. Ian Fleming, Pericyclic Reactions, Oxford Science Publications, Cambridge, 1999.
4. Finar I. L., Organic Chemistry, 6th Edition, Pearson Education Asia, 2004.
5. Rashmi Sanghi, M.M. Srivastava, Green chemistry, Environment Friendly Alternatives, Narosa Publishing House, 2007.
6. Carey F. A., and Sundberg R. J., Advanced Organic Chemistry Part-A and B, 4th edn, Kluwer Academic/Plenum Publishers 2000.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 Questions of 2 Marks each-No choice**20 Marks****PART B :** 2 Questions from each unit of internal choice, each carrying 16 Marks.**80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 4316	INORGANIC QUALITATIVE ANALYSIS	L	T	P	C	Max. Marks
		0	0	3	2	100

COURSE OBJECTIVES

- To learn the theoretical basis of qualitative inorganic analysis
- To understand the method of identification of group and cations using semimicro analysis
- To analyse the mixture and identify the simple and interfering anions in the mixture
- To remove the interfering anion from mixture

LIST OF EXPERIMENTS

Semi micro qualitative analysis of inorganic salt mixtures containing one interfering acid radical
Simple anions – Carbonate, nitrate, sulphate, sulphide, sulphite, chloride and bromide
Interfering anions – Borate, fluoride, oxalate, phosphate, arsenite and chromate.
Cations:
Group I cations: Lead, silver, mercurous.
Group II cations: Mercuric, copper, cadmium, bismuth, antimony, tin.
Group III cations: Aluminium, ferrous, ferric, chromium.
Group IV cations: Cobalt, nickel, manganese, zinc.
Group V cations: Barium, strontium, calcium
Group VI cations: Magnesium, ammonium.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Analyze the mixture using semi micro analysis

CO2: Identify the simple anions and interfering anions in the mixture

CO3: Remove the interfering anion from the mixture

CO4: Identify the cations present in the mixture

CO5: Recognize the classification of various cations under different groups

CO6: Acquire the group separation skills

TEXT / REFERENCE BOOKS

1. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd ed., The National Publishing Company, Chennai, 1974.
2. Vogel's Text Book of Inorganic Qualitative Analysis, 4th ed., ELBS, London, 1974

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCY 1212	GENERAL CHEMISTRY-IV	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To understand the chemistry of aromatic hydrocarbons
- To study the compounds of Boron and Carbon group elements
- To learn the preparation of Nitrogen and Oxygen group elements
- To appreciate the concept of stereochemistry and optical isomerism
- To understand the basic concepts of quantum chemistry

UNIT 1 BORON AND CARBON GROUP ELEMENTS**12 Hrs.**

Group 13 (boron group): extraction of B and Si; types of compounds; reactions of B. Compounds of boron with oxygen: boron sesquioxide, borates, and borax. Boron hydrides-reaction with ammonia, hydroboration, structure of boranes; borohydrides and their uses. Aluminium-amphoteric behaviour, aluminates.

Group 14 (carbon group): catenation and heterocatenation, allotropy of carbon-graphite, diamond, fullerenes and carbon nanotubes (structural features and uses); carbides-salt-like carbides, interstitial carbides, covalent carbides. Silicates-ortho-, pyro-, cyclic-, chain-, sheet-, three dimensional silicates and their properties and structures; silicates in technology-alkali silicates.

UNIT 2 NITROGEN AND OXYGEN GROUP ELEMENTS**12 Hrs.**

Group-15 (nitrogen group): metallic and nonmetallic character of group 15 elements. Compounds of Nitrogen and Phosphorous like N_2H_4 , NH_2OH , HN_3 etc. Phosphorous halides and oxohalides of phosphorous

Group-16 (oxygen group): Types of oxides - basic oxides, amphoteric oxides, acidic oxides, neutral oxides. Oxides of sulphur- S_2O , SO_3 ; oxyacids of sulphur-thionic acid series, peroxyacid series, oxohalides-thionyl compounds (methods of preparation and properties).

UNIT 3 BENZENE AND POLYAROMATIC COMPOUNDS**12 Hrs.**

Structure of Benzene –Stability of the benzene ring – Resonance hybrid - Molecular Orbital picture – Aromaticity – Huckel's rule for benzenoid and non-benzenoid compounds –General methods of preparation– Physical and Chemical Properties – Electrophilic substitution – nitration, sulphonation, halogenation, FriedelCrafts alkylation and acylation with mechanism – Orientation in aromatic disubstitution– orientation and reactivity. Polynuclear aromatic hydrocarbons – Preparation and properties of naphthalene – Structure of anthracene and phenanthrene.

UNIT 4 STEREOCHEMISTRY – II**12 Hrs.**

Optical isomerism – Chirality – Measurement of optical activity – Specific rotation – Enantiomerism and Diastereomerism - Wedge, Fischer, Newmann and Sawhorse projection formulae — Difference between Configuration and Conformation - Absolute and Relative configuration - D and L notation - Cahn-Ingold-Prelog's rules – R and S notation – Optical isomerism in compounds containing more than one carbon atom – Isomerism in tartaric acid - Racemic modification – Racemization - Resolution of racemic mixtures –Asymmetric synthesis (definition only) - Walden inversion.

UNIT 5 BASIC QUANTUM CHEMISTRY**12 Hrs.**

Planck's law - photo electric effect – Compton effect - de Broglie's relationship - Heisenberg's uncertainty principle – Bohr's theory – Derivation for energy of an electron in hydrogen atom – Emission spectrum of hydrogen atom – Zeemann effect - Schrodinger wave equation (no derivation) - significance of wave functions - probability distribution of electrons - radial probability distribution functions.

Max.60 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1:Explain the different types of compounds of boron with oxygen, carbon compounds and silicates

CO2:Explain the preparation and chemical properties and structure of benzene and naphthalene

CO3:Discuss the methods of preparation, properties of nitrogen, phosphorous and oxides of sulphur

CO4:Differentiate the conformation and configuration and explain the concept of absolute and relative configuration, D and L notation, Cahn-Ingold-Prelog's rules and R and S notation

CO5:Apply the concept of Huckel's rule in determining the aromaticity of Benzenoid and Non-Benzenoid compounds

CO6:Derive the energy of electron in hydrogen atom by Bohr's theory

TEXT / REFERENCE BOOKS

- R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th ed., Prentice-Hall of India Limited, New Delhi, 1992.
- Selected topics in inorganic chemistry, R D Madan, G D Tuli & Wahid U Malik, S.Chand publication, 1976.
- Bahl B.S. and ArunBahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).
- S. H. Pine, Organic Chemistry, 5th ed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
- I. L. Finar, Organic Chemistry, Vol-1, 6th ed., Pearson Education Asia. 2004.
- Kalsi P. S., Stereochemistry, 3rd Edition, New Age International Publishers, 1995.
- Eliel E. L., Stereochemistry of Carbon Compounds, Tata-McGraw Hill, 2000.
- B. R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co. 23rd edition, 1993.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 Questions of 2 Marks each-No choice****20 Marks****PART B : 2 Questions from each unit of internal choice, each carrying 16 Marks.****80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 4214	ORGANIC QUALITATIVE ANALYSIS	L	T	P	Credits	Total Marks
		0	0	3	2	100

COURSE OBJECTIVES

1. To develop the students to understand the basic mechanism involved in functional group analysis.
2. To elaborate the student to develop the analytical skill in organic quantitative analysis.
3. To determine the melting point for the prepared organic derivatives.

Identification of Functional group of a given Organic Substance

Identification of acidic, phenolic, basic and neutral organic substances.

Detection of N, S and halogens. Test for aliphatic and aromatic nature of substances. Test for saturation and unsaturation.

Identification of functional groups – Acid – Phenol – Ester - Aldehydes – Ketones – Carbohydrates – Amines – Amide – Anilide - Nitro compound – Thiourea – Halogen compound

Preparation of derivatives for the functional groups and determination of melting point of the derivative.

COURSE OUTCOMES

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

CO1: Identify qualitatively the acidic, phenolic, basic and neutral organic substances.

CO2: Develop the skill in analyzing the special elements present in the organic substances.

CO3: Discuss the aliphatic and aromatic nature of the organic substances.

CO4: Determine the different functional group present in the organic substances.

CO5: Develop the derivatives of the functional group for a given organic substance.

CO6: Determine the melting point of the prepared organic derivatives.

TEXT / REFERENCE BOOKS

1. N.S. Gnanaprasadam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 2002.
2. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.
3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th ed., Pearson Education, 2005.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCY 1612	FUNDAMENTALS OF SPECTROSCOPY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To study the interaction of radiation with matter and selection rules
- To learn the fundamentals of spectroscopic techniques
- To understand the principle and instrumentation of various spectroscopic techniques
- To interpret the spectra of various spectroscopic techniques
- To apply the concept of spectral data to assign the structure of organic compounds

UNIT 1 INTRODUCTION TO SPECTROSCOPY**12 Hrs.**

Interaction of radiation with matter – Electromagnetic spectrum – quantization of energy – Boltzman distribution (formula only) - Electronic, vibrational and rotational energy levels: Relative population – Absorption and emission spectra – Selection rules – line widths – resolution and signal to noise ratio.

UNIT 2 UV-VISIBLE SPECTROSCOPY**12 Hrs.**

Electromagnetic spectrum – Energy-Wavelength relationship – Introduction to UV-VIS spectroscopy – Beer-Lamberts Law – Instrumentation – Bands in UV-VIS spectrum – Possible electronic transitions – Types of electronic transitions based on selection rules – Characteristic absorption (λ_{max} and ϵ_{max}) – Factors influencing absorption – Chromophore, Auxochrome, Bathochromic shift, Hypsochromic shift, Hypochromic shift, Hyperchromic shift.

UNIT 3 IR AND RAMAN SPECTROSCOPY**12 Hrs.**

Introduction to IR spectroscopy – Principle, types of stretching and bending vibrations, vibrational frequencies – Instrumentation – Bands in IR spectrum – Selection rules – Identification of organic molecules from characteristic absorption bands.

Raman spectroscopy – Principle – Raleigh and Raman scattering – Stoke's and antistoke's line – Differences between IR and Raman spectroscopy - Mutual exclusion principle – applications.

UNIT 4 NMR SPECTROSCOPY**12 Hrs.**

Principle of nuclear magnetic resonance – Instrumentation – Shielding mechanism - Chemical shift – Multiplicity – Spin-spin coupling and coupling constants – Splitting of signals - Deuterium labeling – Interpreting the NMR spectra of some organic molecules.

UNIT 5 MASS SPECTROMETRY**12 Hrs.**

Basic principles of mass spectrometry – Molecular ion peak – Base peak – Isotopic peak – Metastable peak and their uses – Fragmentation – m/z values of various fragments – Nitrogen rule - McLafferty rearrangement - Interpreting the mass spectra of some organic molecules – Instrumentation – Combined application in identifying organic compounds.

Max.60 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1: Understand the interaction of radiation with matter, electronic, vibrational and rotational energy levels and selection rules
 CO2: Explain the principle and instrumentation of UV-VIS, IR and Raman, NMR spectroscopy and Mass spectrometry
 CO3: Discuss the types of electronic transitions and factors influencing absorption.
 CO4: Differentiate the IR and Raman spectroscopy and explain the concept of Mutual exclusion principle
 CO5: Explain the concept of spin-spin coupling and coupling constant, Nitrogen rule, McLafferty rearrangement
 CO6: Interpret the spectral data and assign the structure of organic molecules

TEXT / REFERENCE BOOKS

1. Banwell C. N., Fundamentals of Molecular Spectroscopy, Tata McGraw Hill, 1983.
2. Kalsi P. S., Stereochemistry, 3rd Edition, New Age International Publishers, 1995.
3. Barrow G. M., Introduction to Molecular Spectroscopy, McGraw-Hill, 1962.
4. Willard H. H., Merritt Jr. L. L., Dean J. A., and Settle Jr. A. F., Instrumental methods of analysis, 6th Edition, Van Nostrand, 1981.
5. Kemp W., Applications of Spectroscopy, English Language Book Society, 1987.
6. Skoog D. A., West D. M., Holler f. J., and Crouch S. R., Fundamentals of Analytical Chemistry, 9th Edition, Wadsworth Publishing Co. Inc., 2012

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 Questions of 2 Marks each-No choice**20 Marks****PART B :** 2 Questions from each unit of internal choice, each carrying 16 Marks.**80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 1615	CHEMISTRY OF NATURAL PRODUCTS	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To learn about the isolation of alkaloids and structural elucidation of coniine, nicotine, piperine and papaverine.
- To emphasize on the isolation of terpenoids and structural elucidation of citral, menthol, geraniol, camphor and vitamin A.
- To recognize the biological importance of purines and pyrimidines in organic reactions.
- To emphasize on the structural determination of cyanidine chloride and Quercetin.
- To impart an insight into structural details of hormones and Vitamins.

UNIT 1 ALKALOIDS**12 Hrs.**

Classification, isolation, purification, general methods of structure determination - functions of alkaloids. Structural elucidation of coniine, nicotine, piperine and papaverine.

UNIT 2 TERPENOIDS AND CAROTENOIDS**12 Hrs.**

Terpenoids: Introduction, classification, Isoprene rule - General methods of determining structure – Structural elucidation of citral, menthol, geraniol and camphor.

Carotenoids: Introduction, geometrical isomerism, structure determination and synthesis of β -carotene and vitamin A.

UNIT 3 PURINES AND PYRIMIDINES**12 Hrs.**

Purines: Introduction, biological importance - Structure and synthesis of Uric acid, Xanthine and Caffeine - Pyrimidines: Introduction, Structure and synthesis of Uracil and Thymine.

UNIT 4 ANTHOCYANINS AND FLAVONES**12 Hrs.**

Anthocyanins: Introduction to anthocyanins - Structure and general methods of synthesis of anthocyanins - Cyanidine chloride: structure and determination – Flavones and Isoflavones: Structure and determination of flavone and flavonoids - Quercetin: Structure determination and importance.

UNIT 5 HORMONES AND VITAMINS**12 Hrs.**

Hormones: Introduction - Difference between hormones and vitamins. Classification - Structure and functions of steroid hormones: Androsterone - Progesterone - Testosterone - Estrone. Adrenocortical hormones: Cortisone. Vitamins: Structure and importance of Vitamin D - Folic acid - Nicotinamide.

Max.60 Hours**COURSE OUTCOMES**

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

CO1:Elaborate on the methods and structural elucidation of Coniine, Nicotine, Piperine and Papaverine.

CO2:Explain on the structural elucidation of citral, menthol, geraniol, camphor and vitamin A.

CO3:Examine the structure and synthesis of uric acid, Xanthine, caffeine, Uracil and Thymine.

CO4:Discuss on the general methods of synthesis of anthocyanins.

CO5:Explain on the structural elucidation of cyanidine chloride and Quercetin.

CO6:Summarize the structure and functions of hormones and Vitamins..

TEXT / REFERENCE BOOKS

- 1). O. P. Agarwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House, 2002.
- 2). L. Finar, Organic Chemistry, Vol-2, 6th ed., Pearson Education Asia. 2004.
- 3). Gurdeep Chatwal and Anand, Chemistry of Natural Products Vol 1 & 2, Himalayan Publishing Co, 2001.
- 4). Bahl B.S. and ArunBahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 Questions of 2 Marks each-No choice**20 Marks****PART B :** 2 Questions from each unit of internal choice, each carrying 16 Marks.**80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 1214	ALLIED CHEMISTRY – II	L	T	P	Credits	Total Marks
	(Allied for B.Sc., Mathematics, Bio, Physics Department students only)	3	1	0	3	100

COURSE OBJECTIVES

- To know about the types and properties of solutions.
- To expose the students for various separation techniques for the purification of compounds.
- To provide an idea about the chemical kinetics in terms of order, molecularity and their derivations involved.

UNIT 1 SOLUTIONS**12 Hrs.**

Introduction: Solid solution - Hume Rothery's rule. Types of solid solutions: Liquid solutions: Solubility of partially miscible liquids - Phenol-water system. Colligative properties: Lowering of vapour pressure. Raoult's law: Derivation - Osmotic pressure - Isotonic solution - Relationship between osmotic pressure and vapour pressure. Depression in freezing point - Derivation. Elevation in boiling point - Derivation - Problems.

UNIT 2 INTRODUCTION TO SPECTROSCOPY**12 Hrs.**

Electromagnetic spectrum, Absorption of radiation, electronic transition – Vibrational transition – Rotational transition – Intensities of spectral lines – Beer-Lambert law – Colorimetric analysis – Estimation of concentration of a solution by colorimetry – Flame photometry – Theory, Instrumentation (block diagram only) and application – UV-Visible spectroscopy – principles, instrumentation (block diagram only) and IR spectroscopy – simple application only.

UNIT 3 CHEMICAL KINETICS**12 Hrs.**

Introduction, Basic Concepts, Factors affecting reaction rates, rate equations for different orders – Derivation of Zero order, First order, Second order (A+A and A+B) reactions, Half life, problem based on First order and second order kinetics. Methods for the determination of the order of a reaction, Steady state hypothesis, Arrhenius Equation, Energy of activation, complex reactions – kinetics of opposing, parallel and consecutive reactions, Theories of reaction rates – Collision theory, Absolute reaction rate theory.

UNIT 4 SURFACE CHEMISTRY AND CATALYSIS**12 Hrs.**

Adsorption – types of adsorption – Adsorption of gases on solids – adsorption isotherm – Freundlich, Langmuir isotherms – Adsorption of solutes from solutions – applications – Role of adsorption in catalytic reactions – Ion exchange adsorption – basic principles in adsorption chromatography – catalysis – classification – characteristic of catalysts – Auto catalysis – Enzyme catalysis – Michaelis – Menten equation – Acid – base catalysis.

UNIT 5 SEPARATION TECHNIQUES**12 Hrs.**

Distillation techniques: Fractional distillation - Steam distillation - Vacuum distillation. Chromatography: Elution analysis - Paper chromatography - Thin layer chromatography - Liquid chromatography - High performance liquid chromatography (HPLC) - Gas chromatography (GC).

TEXT / REFERENCES

1. Puri B.R., Sharma L. R., Madan. S. Pathania, Principles of Physical Chemistry, 41 Edition, Vishal Publishing co., 2004.
2. Keith J. Laidler, Chemical Kinetics, Third Edition, Pearson education limited, 2004.
3. Atkins P. W., Physical Chemistry, 6 edition, Oxford University press, 1998.
4. Barrow G. M., Physical Chemistry, 5th edition, McGraw-Hill, 1988.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 Questions of 2 Marks each-No choice**20 Marks****PART B :** 2 Questions from each unit of internal choice, each carrying 16 Marks.**80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 4218	ALLIED CHEMISTRY LAB – II	L	T	P	Credits	Total Marks
	(Allied for B.Sc., Mathematics, Bio, Physics Department students only)	0	0	3	2	100

COURSE OBJECTIVES

- To understand the basics of chemistry laboratory
- To understand and correlate the theory with laboratory

Objectives: To enable the students to understand better the concepts of organic analysis and appreciate better the applications of organic chemistry towards biological systems.

Organic Analysis:

- a) Identification of acidic, basic, phenolic and neutral organic substances
- b) Detection of N, S and halogens
- c) Test for aliphatic and aromatic nature of substances.
- d) Test for saturation and unsaturation.
- e) Identification of functional groups i) Carboxylic acid ii) Phenols iii) Aldehydes iv) Ketones v) Esters v

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCY 1311	INORGANIC CHEMISTRY I	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To elaborate on the general characteristics, oxidation reduction processes and catalytic applications of coordination compounds.
- To explain the chelate effect, types of isomerism and the theories related to coordination complexes.
- To understand the importance of crystal field splitting based on the theories and correlating them with the properties of the complexes.
- To understand the formation and stability of various organometallic compounds based on EAN rule.
- To learn the properties and uses of important inorganic oxidizing and reducing compounds.

UNIT 1 d-BLOCK ELEMENTS**12 Hrs.**

First, second and third transition series, general characteristics, metallic character, atomic and ionic radii, standard reduction potentials, variable oxidation states and stabilization, colour, complex formation, catalytic and magnetic properties. Origin of magnetism, measurements by Gouy's balance method, Electroneutrality principle, coordination numbers, coordination numbers from 1 – 10 with examples, Kepert model.

UNIT 2 COORDINATION CHEMISTRY I**12 Hrs.**

Introduction- Types of ligands, coordination number, IUPAC nomenclature, chelate effect - Isomerism- linkage, ionization, hydrate, coordination, coordination position isomerism. Stereoisomerism- geometrical (cis-/trans- and fac-/mer-), optical isomerism in 4 and 6 coordinated complexes. Theories of coordination compounds-Werner's and Sidgwick's EAN concept.

UNIT 3 COORDINATION CHEMISTRY II**12 Hrs.**

Valence bond theory-applications and limitations, hybridization, geometry and magnetic properties of tetrahedral and octahedral complexes. Crystal field theory- splitting of 'd' metal orbitals in octahedral, tetrahedral and square planar complexes-factors influencing the magnitude of crystal field splitting, low-spin and high-spin complexes, Jahn Teller distortion, explanation of colour and magnetic properties, comparison of VBT and CFT, spectrochemical series.

UNIT 4 ORGANOMETALLIC COMPOUNDS**12 Hrs.**

Definition, Types of organometallic compounds, Classification of ligands, EAN and Nomenclature of organometallic compounds. Preparation, reaction and structure of ferrocene, metal-olefins and metal -alkynes complexes. Carbonyl compounds of transition metals, structure of mono and polynuclear carbonyls.

UNIT 5 INORGANIC COMPOUNDS**12 Hrs.**

Preparation, properties, uses and structures of $\text{Ti}(\text{NO}_3)_4$, TiO_2 , VOCl_2 , K_2CrO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$, Chromyl chloride, Manganese dioxide, Potassium permanganate, potassium ferrocyanide, potassium ferricyanide, Prussian blue, sodium nitroprusside, Lithium aluminium hydride, aluminium chloride, hexamine cobalt(III) chloride, Cuprous chloride.

Max.60 Hours**COURSE OUTCOMES**

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

- CO1: Explain the characteristics and mechanism involved in oxidation and reduction processes taking place in coordination compounds.
 CO2: Discuss the chelate effect and theories related to transition metal complexes.
 CO3: Understand the properties exhibited by the coordination complexes based on CFSE.
 CO4: Analyze the structure and isomerism in coordination complexes and explain the color and magnetic properties of coordination complexes.
 CO5: Understand the stability of complexes based on EAN rule and design the structure.
 CO6: Identify important inorganic oxidizing and reducing agents for organic conversion and catalytic applications.

TEXT / REFERENCE BOOKS

1. Advanced Inorganic Chemistry, F.A. Cotton and G. Wilkinson, Wiley Eastern Private Limited 1992.
2. Inorganic Chemistry: Principles of Structure and Reactivity, J.E. Huheey, E.A. Keiter and R.L. Keiter, Addison-Wiley Publication Company, 1993.
3. Inorganic Chemistry, D.F. Shriver, P.W. Atkins, C.H. Longford, Oxford University Press, 1996
4. Concise Coordination Chemistry, R. Gopalan and V. Ramalingam, Vikas Publishing House Private Limited, 2001.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 Questions of 2 Marks each-No choice****20 Marks****PART B : 2 Questions from each unit of internal choice, each carrying 16 Marks.****80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 1312	ORGANIC CHEMISTRY-I	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To understand the mechanism for substitution, elimination and addition reactions.
- To learn the importance of alcohols and phenols in organic reactions.
- To emphasize on chemical reactions involving ethers and epoxides.
- To recognize the importance of carbonyl compounds in organic reactions.
- To impart an insight into chemistry of carbohydrates.

UNIT 1 ALKYL AND ARYL HALIDES**12 Hrs**

Structure and Nomenclature– General methods of Preparation– Sandmeyer and Gattermann reactions -Physical and Chemical properties – Nucleophilic substitution reactions (S_N1 , S_N2 , S_Ni and S_NAr), Reduction, Eliminations: E1 and E2 mechanisms – Mechanism – Formation of Grignard reagents, addition - Williamson's ether synthesis.

UNIT 2 ALCOHOLS AND PHENOLS**12 Hrs.**

Alcohols –Structure, nomenclature and classification – Methods of preparation - hydration, hydrolysis, reduction of carbonyl compounds, from Grignard reagents – Physical and chemical properties – Reactions involving OH bond –Glycol, glycerols and thiols.
Phenols – Structure and nomenclature - Preparation from diazonium salts and sulphonic acid, hydrolysis - Physical and chemical properties –reactions involving OH group, acidity, ether formation, esterification – reactions involving the benzene ring, electrophilic substitution, nitration, sulphonation, halogenation, Friedel-Craft's reaction, coupling reactions, Kolbe's reaction and Reimer-Tiemann reaction.

UNIT 3 ETHERS AND EPOXIDES**12 Hrs.**

Structure and nomenclature - Preparation by Williamson's synthesis and by dehydration of alcohols - Physical and Chemical properties – Halogenation, formation of peroxides, hydrolysis, cleavage of C-O bond. Thioethers – Structure – Preparation and Properties - Crown ethers - Preparation and reactions of epoxides.

UNIT 4 CARBONYL COMPOUNDS**12 Hrs.**

Structure and nomenclature– General methods of preparation of aldehydes and ketones – oxidation, dehydrogenation, from Grignard reagents, Rosenmund reduction, Gattermann-Koch reaction - Physical and Chemical properties –Reactivity of carbonyl group and acidity of alpha hydrogen - Nucleophilic addition reactions – Mechanism of Aldol, Perkin, Knoevenagel, Claisen, Wittig, Cannizzaro, Reformatsky and Benzoin reactions – Oxidation and Reduction reactions –Clemmensen and Wolf-Kishner reduction – Electrophilic substitution reactions of aromatic aldehydes and ketones.

UNIT 5 CARBOHYDRATES**12 Hrs.**

Classification and nomenclature– Monosaccharides: Stereochemistry – Conversion to next higher aldose -Kiliani-Fischer synthesis –Conversion to next lower aldose – Ruff's method - Building up of the sugar series – Reducing and non-reducing sugars - Glucose and Fructose (open chain and cyclic structure – Fisher and Haworth structure) – Structural elucidation of glucose – Epimerization and mutarotation - Physical and Chemical properties – Reactions of the open chain and cyclic form - Disaccharides: Sucrose, Lactose and Maltose – Ring structures (Haworth formula) – Polysaccharides: Starch and cellulose (structure only).

Max.60 Hrs**COURSE OUTCOMES**

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

CO1: Interpret and analyze the products in organic chemical reactions involving Substitution, Elimination and addition reactions of alkyl and aryl halides

CO2: Explain the chemical reactions in alcohols and phenols.

CO3: Examine the chemical reactions involving ethers and epoxides.

CO4: Analyze the reactivity of carbonyl group their preparations and properties.

CO5: Predict the oxidation, reduction and name chemical reactions based on carbonyl compounds.

CO6: Understand the stereochemistry and structure of monosaccharides, disaccharides and polysaccharides

TEXT / REFERENCE BOOKS

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th ed., Prentice-Hall of India Limited, New Delhi, 1992.
2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).
3. S. H. Pine, Organic Chemistry, 5th ed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
4. I. L. Finar, Organic Chemistry, Vol-1, 6th ed., Pearson Education Asia. 2004.
5. I. L. Finar, Organic Chemistry, Vol-2, 6th ed., Pearson Education Asia. 2004.
6. J. March and M Smith, Advanced Organic Chemistry, 5th ed., John-Wiley and sons, 2001.
7. Agarwal O. P., Chemistry of Organic Natural Products, Vol. 1, Goel Publishing House, 1997.
8. Jain J. L., Jain S., and Jain N., Fundamentals of Biochemistry, S. Chand, 2007

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 Questions of 2 Marks each-No choice****20 Marks****PART B : 2 Questions from each unit of internal choice, each carrying 16 Marks.****80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 1313	PHYSICAL CHEMISTRY-I	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To understand the concepts of thermodynamics.
- To understand the concepts and applications of electrolytic conductance.
- To study the rate the order of reactions.
- To study the phase rule and its application to different system.

UNIT 1 THERMODYNAMICS-I**12 Hrs**

State functions E and H – Concept of ideal gas: Gas laws, Kinetic theory of gases – postulates and derivation – Deviation from ideal behaviour – Vander-Waals equation of state – derivation – First law of thermodynamics - Applications of the laws of thermodynamics to ideal gases: Heat capacity, relation between C_p and C_v – Isothermal process: Change in internal energy, work done, W (rev) and W (irrev) – Adiabatic process: work done, and entropy changes – Application of the laws of thermodynamics to real (vander Waals) gases: Isothermal process – Work done, change in internal energy, heat absorbed – Adiabatic process: Work done – Joule-Thomson effect – Joule-Thomson coefficient and its significance, inversion temperatures – Variation of enthalpy change of reaction with temperature (Kirchoff's equation) – Zeroth law of thermodynamics.

UNIT 2 ELECTROCHEMISTRY-I**12 Hrs**

Metallic and electrolytic conductors – Faraday's laws of electrolysis – Specific, equivalent and molar conductance – Determination of conductance – Variation of equivalent conductance with dilution – Kohlrausch's law and its applications – Transport number – Absolute velocity of ions and ionic mobility – Determination of transport number – Hittorf's method and moving boundary method – Applications of conductance measurements – Determination of i) Ionic product of water, ii) Solubility of sparingly soluble salt and iii) Degree of dissociation – Conductometric titrations.

UNIT 3 THEORIES OF IONISATION**12 Hrs**

Arrhenius theory of electrolytic dissociation – Ostwald's dilution law – Limitations of Arrhenius theory – Theory of strong electrolytes – Debye-Huckel-Onsager theory – Inter-ionic effect – Asymmetry effect – Electrophoretic effect – Debye-Falkenhagen effect – Wien effect – Mean activity coefficient – Ionic strength – Limiting law equation,

UNIT 4 CHEMICAL KINETICS-I**12 Hrs**

Rate of reaction – Factors influencing rates of reactions – Order and molecularity of reaction – Derivation of rate constant of Zero, First, Second, Third, Pseudo-order reactions – Half-life of reaction – Determination of order of reaction – Integration method, Graphical method, Half-life method.

UNIT 5 PHASE EQUILIBRIA**12 Hrs**

Gibb's phase rule: Terms-phase, component and degree of freedom – Phase diagram of one component system - Water and Sulphur systems – Reduced phase rule – Phase diagram of two component system – Simple eutectic – Pb-Ag systems, desilverisation of lead – Phase diagram of system with compound formation with congruent melting point – Mg-Zn and FeCl_3 -Water system – Incongruent melting point – Na-K system.

Max. 60 Hrs.**COURSE OUTCOMES**

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

- CO1: Learn the basics of law of thermodynamics.
 CO2: Analyze and interpret the laws of thermodynamics and its applications.
 CO3: Discuss the importance of conductance of electrolytic solutions.
 CO4: Learn and understand the advanced electrochemistry.
 CO5: Understand the derivation of rate laws.
 CO6: Construct and interpret the phase diagram for one component and two component systems.

TEXT/REFERENCE BOOKS

1. B. R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co. 23rd edition, 1993.
2. ArunBahl, B. S. Bahl and G. D. Tuli, *Essentials of Physical Chemistry*, S. Chand publishing, 2012
3. P.W. Atkins, *Physical Chemistry*, 7th ed., Oxford university press, 2001.
4. Glasston & Lewis, *Physical Chemistry*, 2nd Edition, McMillan publishers, 1973
5. A.S. Negi and S. C. Anand, *A Textbook of Physical Chemistry*, New Age International, 2004

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 Marks each-No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 16 Marks.**80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 4315	INDUSTRIAL CHEMISTRY LAB	L	T	P	C	Max. Marks
		0	0	3	2	100

COURSE OBJECTIVES

- To promote industry based analytical skills.

LIST OF EXPERIMENTS

1. Determination of Chemical oxygen demand in a wastewater sample
2. Estimation of available chlorine in Bleaching Powder
3. Determination of Saponification value of oil.
4. Determination of TFM & Alkalinity of given soap.
5. Analysis Pyrolusite ore.
6. Estimation of Cu in ore by Spectrophotometric method
7. Determination of the rate of corrosion of Iron in Mild steel by hydrogen evolution method.
8. Determination of molecular weight of polymer by viscosity measurement method
9. Verification of the Freundlich isotherm by using acetic acid.
10. Determination of the current density of battery

COURSE OUTCOMES

On successful completion of the course, student will be able to
 CO1: To understand and interpretations of analysis report of water.
 CO2: Analytical skills to estimate and interpretations of soap
 CO3: Analytical skills to estimate the constituent present in ore.
 CO4: Analytical skills to estimate the molecular weight of polymer

TEXT / REFERENCE BOOKS

1. V.V. Ramanujam, Industrial Chemistry Analysis, 3rd ed., The National Publishing Company, Chennai, 1974.
2. Vogel's Text Book of Inorganic Qualitative Analysis, 4th ed., ELBS, London, 1974

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCY1616	POLYMER CHEMISTRY	L	T	P	C	Max. Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To learn the characteristics and classification of polymers.
- To explain the mechanism of polymerization in the formation of polymers.
- To learn different types of polymerization reactions and various polymer degradation processes.
- To elaborate on the properties of thermoplastics and thermosetting polymers.
- To learn the compounding process in polymers and to understand the different moulding methods.

UNIT 1 INTRODUCTION TO POLYMERS**12 Hrs.**

Monomers, Oligomers, Polymers and their characteristics. Classification of polymers: Natural, synthetic, linear, cross linked and network, Plastics, elastomers, fibres, Homopolymers and Co-polymers. Bonding in polymers: Primary and secondary bond forces in polymers, cohesive energy. Determination of Molecular mass of polymers: Number Average molecular mass (M_n) and weight average molecular mass (M_w) of polymers.

UNIT 2 MECHANISM OF POLYMERIZATION**12 Hrs.**

Chain growth polymerization: Cationic, anionic, free radical polymerization, Stereo regular polymers: Ziegler Natta polymerization, Step growth polymerisation.

UNIT 3 TECHNIQUES OF POLYMERIZATION AND POLYMER DEGRADATION**12 Hrs.**

Bulk, Solution, Emulsion, Suspension, interfacial and gas phase polymerization. Types of Polymer Degradation, Thermal degradation, mechanical degradation, photodegradation, Photo stabilizers.

UNIT 4 INDUSTRIAL POLYMERS**12 Hrs.**

Preparation of fibre forming polymers, elastomeric material. Thermoplastics: Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester. Thermosetting Plastics: Phenol formaldehyde and epoxide resin. Elastomers: Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene. Conducting Polymers: Elementary ideas, examples: poly sulphur nitriles, poly phenylene, poly pyrrole and poly acetylene.

UNIT 5 INTRODUCTION TO POLYMER PROCESSING**12 Hrs.**

Compounding: Polymer Additives: Fillers, Plasticizers, antioxidants, thermal stabilizers, fire retardants and colourants. Processing Techniques: Calendaring, die casting, compression moulding, injection moulding, blow moulding and reinforcing.

Max.60 Hrs.**COURSE OUTCOMES**

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

- CO1: Explain the characteristics and classification of polymers.
 CO2: Discuss the mechanism involved in different types of polymerization reactions.
 CO3: Understand the different types of polymerization reactions and polymer degradation processes.
 CO4: Analyze the different types of polymers starting from various sources.
 CO5: Understand the basics of conducting polymers and their types.
 CO6: Identify different compounding agents and their importance in moulding methods.

TEXT / REFERENCE BOOKS

1. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995
2. G.S. Misra, Introductory Polymer Chemistry, New Age International (Pvt) Ltd, 1996
3. F. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971
4. A. Kumar and S.K. Gupta, Fundamentals of Polymer Science and Engineering, Tata McGraw-Hill, 1978

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 Questions of 2 Marks each-No choice**20 Marks**

PART B : 2 Questions from each unit of internal choice, each carrying 16 Marks.
 (Out of 100 Marks, maximum of 10% problems may be asked.)

80 Marks

SCY 1112	GENERAL CHEMISTRY-II	L	T	P	Credits
		3	1	0	4

COURSE OBJECTIVES

- To learn the theoretical aspects of qualitative analysis and gravimetric analysis
- To study the structure of atoms and periodic properties of elements
- To understand the structure and reactivity of organic molecules
- To learn various methods of preparation and reactions of hydrocarbons
- To study the ideal and real solutions and colloids

UNIT 1 ANALYTICAL METHODS-II**12 Hrs.**

Classification of analytical methods, advantages of instrumental methods - Qualitative Inorganic Analysis: Dry test, flame test, Cobalt nitrate test - Wet confirmatory tests for acid radicals - Interfering acid radicals- Theory of Interference- Elimination of Interfering acid radicals. Gravimetric analysis: mechanism of precipitation – solubility products –common ion effect – Types of precipitation – co-precipitation and post precipitation – homogeneous precipitation - General rules for precipitation Effect of digestion - washing of precipitates- Drying of precipitates Types, care and use of crucibles.

UNIT 2 PERIODIC TABLE AND PERIODIC PROPERTIES**12 Hrs.**

Periodicity-Periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number. Horizontal, vertical and diagonal relationships in the periodic table. Properties of atoms- Size of atoms and ions-atomic radii, ionic radii, covalent radii, trend in ionic radii, ionization potential, electron affinity, electronegativity - Simple problems.-Pauling, Mulliken-Jaffe, Allred-Rochow definitions, oxidation states and variable valency, isoelectronic relationship, inert-pair effect. Atomic, molecular and equivalent weights, Avogadro's principle and mass-volume relationship.

UNIT 3 STRUCTURE AND REACTIVITY OF ORGANIC COMPOUNDS**12 Hrs.**

Types of organic reactions - Cleavage of bonds - Homolytic and Heterolytic bond fission -Reactive intermediates - carbocation, carbanion, and free radicals - Structure, shape, stability and reactivity -Carbenes, nitrenes and arynes - Factors affecting stability of the reaction intermediates - Electron displacement effects - Inductive effect, electromeric, mesomeric, resonance, hyperconjugation- Hydrogen bonding - Tautomerism – Keto-enol tautomerism

UNIT 4 ALKANES AND CYCLOALKANES**12 Hrs.**

Structure – Nomenclature – General methods of preparing alkanes - Preparation by Wurtz reaction and Kolbe's method – Physical and Chemical properties – Substitution: Halogenation, nitration, sulphonation, oxidation, pyrolysis, aromatization with mechanism - Cycloalkanes – Nomenclature – Preparation by Wurtz reaction, Dieckmann's ring closure, Clemmensen's reduction - Physical and Chemical Properties - Mechanism of substitution and ring opening reactions – Baeyer's strain theory.

UNIT 5 SOLUTIONS AND COLLOIDS**12 Hrs.**

Solutions - Solutions of gases in liquids - Henry's law - solution of liquids in liquids. Raoult's law. Binary liquid mixtures - ideal solutions - deviations from ideal behaviour - vapour pressure - composition and vapour pressure - temperature curves - azeotropic distillation, Partially miscible binary systems (CST-UCST, LCST, and both UCST and LCST). Colloids - lyophilic and lyophobic colloids. Optical and Kinetic properties, electrophoresis and electro osmosis, peptisation, and coagulation (Definition only)

Max. 60 Hrs**COURSE OUTCOMES**

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

- CO1: Aware the fundamentals of inorganic qualitative analysis.
 CO2: Gain the theoretical knowledge of gravimetric analysis.
 CO3: Understand the basic structure of atoms and periodicity of elements.
 CO4: Analyze the structure, shape, stability and reactivity of organic compounds.
 CO5: Understand the chemistry of alkanes and cycloalkanes.
 CO6: Learn the concept of dilute solution and the various properties of colloids.

TEXT / REFERENCE BOOKS

8. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007.
9. Selected topics in inorganic chemistry, R D Madan, G D Tuli & Wahid U Malik, S.Chand publication, 1976.
10. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th ed., Prentice-Hall of India Limited, New Delhi, 1992.
11. Bahl B.S. and ArunBahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).
12. S. H. Pine, Organic Chemistry, 5th ed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
13. J. March and M Smith, Advanced Organic Chemistry, 5th ed., John-Wiley and sons, 2001.
14. B. R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co. 23rd edition, 1993.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 Marks each-No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 16 Marks.**80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 4112	GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATIONS LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

COURSE OBJECTIVES

- To understanding the concept of gravimetric analysis
- To learn the chemistry of various organic preparations

LIST OF EXPERIMENTS

1. Estimation of Barium as Barium Sulphate.
2. Estimation of Barium as Barium Chromate.
3. Estimation of Lead as Lead Chromate.
4. Estimation of Nickel as Ni-DMG.
5. Estimation of Calcium as Calcium oxalate.
6. Estimation of Copper in an alloy.

ORGANIC PREPARATIONS**SINGLE STAGE ORGANIC PREPARATIONS**

1. Oxidation-Benzaldehyde to benzoic acid.
2. Hydrolysis-Methyl salicylate or ethyl benzoate to the acid.
3. Nitration- Meta dinitrobenzene or picric acid.
4. Halogenation- parabromoacetanilide from acetanilide.

TEXT / REFERENCE BOOKS

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt., 1996.
2. Vogel's Text Book of Quantitative Chemical Analysis. 5th Edi., ELBS/Longman England, 1989.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCY 1211	GENERAL CHEMISTRY III	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To learn chemical reactions and theories of acids and bases, oxidation reduction processes and electron transfer reactions.
- To understand the properties and chemical reactions of s-block elements and their compounds.
- To learn the preparation, nomenclature and structure of halogen compounds, dienes and alkynes.
- To understand stereochemistry of organic compounds from geometric isomerism, conformers and their interconversions.
- To learn different colligative properties and their application in studying association, dissociation and solvation processes.

UNIT 1 ACIDS AND BASES**12 Hrs.**

Types of chemical reactions- Acid-base, oxidation-reduction, electron transfer and double decomposition reactions. Balancing chemical reactions by oxidation number and ion electron method. Theories of acids and bases- Arrhenius theory of acids and bases in protic solvents. Bronsted-Lowry theory, Lewis theory, the solvent system. Lux-Flood definition and Usanovich definition, HSAB principle.

UNIT 2 s-BLOCK ELEMENTS**12 Hrs.**

Chemical properties of the metals: reaction with water, air, nitrogen; uses of s-block metals and their compounds. Compounds of s-block metals: oxides, hydroxides, peroxides, superoxides-preparation and properties; oxo salts-carbonates, bicarbonates, nitrates; halides and polyhalides; anomalous behavior of Li, Be and B, extraction of beryllium. Complexes of s-block metals: complexes with crown ethers, biological importance of sodium and potassium. organometallic compounds of Li, Be.

UNIT 3 ALKENES, DIENES AND ALKYNES**12 Hrs.**

Structure and Nomenclature-Methods of Preparation-Dehydration of alcohols, dehydrohalogenation of alkyl halides, dehalogenation-Physical and Chemical Properties-Addition of hydrogen, halogen, hydrohalogenation(Markovnikov's and Anti-Markovnikov's rule)-Polymerization-Hoffmann and Saytzeff rules-Elimination mechanism-syn and anti-addition. Dienes-Conjugated, Non-conjugated dienes, cumulative dienes-Structure-1, 3-butadiene-Preparation and properties-Diels Alder reaction. Alkynes-Structure and Nomenclature-Isomerism-Methods of preparation-physical properties-Addition, Substitution, Oxidation, Polymerization.

UNIT 4 STEREOCHEMISTRY-I**12 Hrs.**

Geometrical Isomerism-Cis and trans, syn and anti, E and Z notations-Cis-trans interconversion-Conformational isomerism: Conformers, dihedral angle, torsional strain-Conformational analysis of ethane and n-butane, conformers of cyclohexane (Chair, boat and skew boat forms), axial-equatorial positions and their interconversions, conformers of mono and disubstituted cyclohexanes - diaxial interactions.

UNIT 5 COLLIGATIVE PROPERTIES**12 Hrs.**

Colligative properties: Determination of molecular weight-relative lowering of vapour pressure-Elevation of boiling point-Depression of freezing point-Thermodynamics derivation for elevation of boiling point and depression of freezing point-Relationship between osmotic pressure and Vapour pressure-Vant Hoff's theory of dilute solutions-Distribution law: Thermodynamic derivation, limitation of the law, application in studying association, dissociation and solvation.

Max.60 Hrs.**COURSE OUTCOMES**

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

- CO1: Explain chemical reaction between acids and bases, electron transfer reactions and redox reactions.
 CO2: Discuss the properties and reactions of s-block elements and their compounds.
 CO3: Understand the method of preparation, naming and structure of halogen compounds and dienes.
 CO4: Analyze the structure and isomerism in alkynes and study of their reaction in addition, substitution, oxidation and polymerization reactions.
 CO5: Understand different types of geometrical isomerism and conformers in selective compounds and their interconversions
 CO6: Identify colligative properties and their applications in association, dissociation and solvation processes.

TEXT / REFERENCE BOOKS

1. Kalsi P. S., Stereochemistry, 3rd Edition, New Age International Publishers, 1995.
2. Selected topics in inorganic chemistry, R D Madan, G D Tuli & Wahid U Malik, S.Chand publication, 1976.
3. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th ed., Prentice-Hall of India Limited, New Delhi, 1992.
4. Bahl B.S. and ArunBahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).
5. S. H. Pine, Organic Chemistry, 5th ed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
6. I. L. Finar, Organic Chemistry, Vol-1, 6th ed., Pearson Education Asia. 2004.
7. B. R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chandand Co. 23rd edition, 1993.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 Marks each-No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 16 Marks.**80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 4213	PHYSICAL CHEMISTRY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

COURSE OBJECTIVES

- To improve the analytical skills of the students in quantitative analysis.

LIST OF EXPERIMENTS

1. Kinetics of acid catalyzed hydrolysis of methyl acetate.
2. Determination of molecular weight by Rast's method (using naphthalene, or biphenyl as solvent and acetanilide, p-dichlorobenzene as solute).
3. Critical solution temperature: Phenol-water system. Effect of impurities on CST
4. Phase diagram of a simple eutectic system and determination of unknown composition.
5. Conductometry: Acid – base titration.
6. Potentiometry: Redox titration of ferrous vs dichromate.
7. pH metry: Acid – base titration
8. Verification of Beer-Lambert's law and determination of concentration of metal ions spectrophotometrically.
9. Determination of partition coefficient of iodine between water and carbon tetrachloride.
10. Determination of equivalent conductance of an electrolyte.

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

CO1: Estimate the molecular weight of the unknown solute.

CO2: To Determine the Critical Solution Temperature of the organic compounds.

CO3: To Estimate the amount of metals ion present in unknown solution using photocolourimetry.

TEXT / REFERENCES

1. J.N. Gurthu and R. Kapoor: Advanced Experimental Chemistry, S. Chand and Co., 1987.
2. David P. Shoemaker, Carl W. Garland, Joseph W. Nibler: Experiments in Physical Chemistry, 5th Ed. McGraw- Hill Book company, 1989
3. W. G. Palmer: Experimental physical chemistry, Cambridge University Press.
4. J. B. Yadav: Advanced Practical Physical Chemistry, Goel Publishing House.
5. R. C. Das and B. Behra: Experiments in Physical Chemistry, Tata McGraw hill.
6. K. K. Sharma : An Introduction of Practical Chemistry, Vikas Publishing House, New Delhi

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCY 1611	Analytical Chemistry	L	T	P	Credits	Total marks
		3	1	0	4	100

COURSE OBJECTIVES

- To enable the students learn the principles of separation and purification techniques.
- To understand the principles of various chromatographic techniques.
- To construct the techniques for separation of metal ions using various chromatographic methods.
- To develop the skill of learning various thermal methods.
- To discuss the basic principle of polarimetry and amperometry methods.

UNIT 1 SEPARATION AND PURIFICATION TECHNIQUES**12 Hrs.**

Principles involved in the separation of precipitates, solvent extraction and electrophoresis. Purification of solid organic compounds, extraction - use of immiscible solvents, Soxhlet extraction, crystallization, use of miscible solvents, fractional crystallization, sublimation. Purification of liquids, experimental techniques of distillation, fractional distillation, vacuum distillation, steam distillation, tests for purity.

UNIT 2 CHROMATOGRAPHY I**12 Hrs.**

Principles adsorption, thin layer, partition and paper. Chromatography column chromatography, adsorbents, preparation of column, adsorption, elution, recovery of substance and applications. TLC - choice of adsorbent and solvent, preparation of chromatogram and applications, R_f value. Paper chromatography, Solvents used and principles, factors affecting R_f value, separation of amino acid mixtures. Radial paper chromatography.

UNIT 3 CHROMATOGRAPHY II**12 Hrs.**

Ion exchange chromatography – principle, resins, action of resins, experimental techniques, applications, separation of Zn-Mg, Co-Ni, Cd-Zn, Chloride, bromide. Gas chromatography and high pressure liquid chromatography – principles, Detectors, experimental techniques, instrumentation and applications.

UNIT 4 THERMAL ANALYSIS**12 Hrs.**

Thermal analytical methods - Principle involved in thermogravimetric analysis and differential gravimetric analysis, discussion of various components with block diagram, characteristics of TGA and DTA, factors affecting TGA and DTA curves, thermometric titrations.

UNIT 5 POLAROGRAPHY**12 Hrs.**

Principle, concentration polarization, dropping mercury electrode, advantages and disadvantages, convection, migration and diffusion currents, Ilkovic equation (derivation not required) and significance, experimental assembly, electrodes, capillary solutions, current voltage curve, oxygen wave, influence of temperature and agitation on diffusion layer, polarography as an analytical tool in quantitative and qualitative analysis. Amperometry - basic principles and uses. Polarimetry principle – instrumentation, comparison of strengths of acids, estimation of glucose.

Max.60 Hours**COURSE OUTCOMES**

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

- CO1: Explain the principles involved in various separation techniques and its purification.
- CO2: Discuss the basic principles and applications of different chromatographic techniques.
- CO3: Determine the various chromatographic techniques for efficient separation of metal ions and its applications.
- CO4: Discuss the principle and instrumentation of various thermal methods and thermometric titrations.
- CO5: Explain the principles in polarography and amperometry techniques.
- CO6: Construct the Ilkovic equation for dropping mercury electrode.

TEXT / REFERENCE BOOKS

1. Concise Inorganic Chemistry – J.D. Lee – 3rd Edition, Van Nostrand
2. Inorganic Chemistry – P. L. Soni – Sultan Chand
3. Inorganic Chemistry – Pun and Sharma Nagin
4. Inorganic Chemistry – Modan S. Chand
5. Advanced Inorganic Chemistry – Cotton and Wilkinson
6. A Textbook of Inorganic Chemistry – A.K. De – New Age
7. Industrial Chemistry- B.K. Sharma – Goel Publications
8. General and Inorganic Chemistry Part I Sarkar, Books and Allied (P) Ltd
9. General and Inorganic Chemistry Part II Sarkar, Books and Allied (P) Ltd
10. Chemical Methods for Environmental Analysis Ramesh and Anbu, Macmillan

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 Marks each-No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 16 Marks.**80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 1213	ALLIED CHEMISTRY – I (Allied for B.Sc., Mathematics, Bio, Physics Department students only)	L	T	P	Credits	Total Marks
		3	1	0	3	100

COURSE OBJECTIVES

- To know about the quality parameters of water and methods to estimate the toxic elements and softening methods.
- To understand the properties and various synthetic methods for the preparation of nanomaterials and their applications.
- To give an overview about types of batteries and fuel cells, corrosion mechanisms and preventive methods.
- To have a basic idea about polymers and various moulding techniques.

UNIT 1 WATER TECHNOLOGY**12 Hrs**

Introduction: Water quality parameters - Contamination of water by arsenic, lead, fluoride, mercury and their removal. Hardness: Types - Expression - Units. Estimation of hardness of water by EDTA method - Problems. Estimation of iron, calcium and magnesium: AAS method. Water softening: Zeolite process - Demineralization process. Desalination: Reverse osmosis - Electrodialysis.

UNIT 2 ELECTROCHEMICAL POWER SOURCES**12 Hrs**

Electrochemistry: Galvanic cell - Electrochemical cell representation - EMF series and its significance. Batteries: Terminology - Lead-acid accumulator - Nickel-cadmium batteries. Lithium batteries: Li/SOCl₂ cell- Lithium ion batteries. Fuel Cells: Hydrogen-oxygen fuel cells - Solid oxide fuel cell (SOFC).

UNIT 3 PHASE EQUILIBRIA**12 Hrs**

Introduction: Definition of phase rule - Terms involved in phase rule with examples. One component system: Water system. Two component alloy systems: Classification - Reduced phase rule - Thermal analysis. Simple eutectic system: Lead-silver system. Congruent system: Zinc-magnesium system. Incongruent system: Sodium potassium system.

UNIT 4 SYNTHESIS OF NANOMATERIALS**12 Hrs**

Introduction: Nanomaterials: Definition - Classification based on dimensions - Size dependent properties. Types of nanomaterials: Nanoparticles: Synthesis by chemical reduction method. Nanoporous materials: Synthesis by sol-gel method. Nanowires: Synthesis by VLS mechanism. Carbon Nanotubes (CNTs): Single walled and multi walled nanotubes - Applications of CNTs - Synthesis of CNTs by electric arc discharge method and laser ablation method.

UNIT 5 POLYMER CHEMISTRY**12 Hrs**

Introduction to polymers: Nomenclature - Functionality. Types of polymerization. Mechanism of polymerization: Free radical mechanism - Cationic mechanism - Anionic mechanism. Plastics: Types - Thermoplastics and thermosetting plastics. Properties: Strength - Crystalline and amorphous state - Average molecular weight - Polydispersity. Compounding of plastics. Moulding of plastics: Compression moulding - Injection moulding - Extrusion moulding. Introduction to conducting polymers.

COURSE OUTCOMES

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

CO1: Understand the various water softening and desalination techniques and Contamination in water

CO2: Understand the cell description, charging and discharging Characteristics of Lead-acid accumulator, Nickel-Cadmium battery and Lithium batteries.

CO3: Develop a eutectic phase diagram using thermal analysis

CO4: Understand the various synthetic methods and properties of Nanoparticles, Nanowires, Nanoporous materials and CNTs.

CO5: Understand the types of polymerization and various mechanism involved

TEXT/REFERENCES

1. Jain P.C. and Monica Jain, Engineering Chemistry, 15th Edition Dhanpat Rai Publishing Co., 2009.
2. Dara S.S., Text Book of Engineering Chemistry, S. Chand & Co, 2008.
3. Sheik Mideen A., Engineering Chemistry (I & II), 13th Edition, Shruthi Publishers, 2010.
4. Kuriakose J.C. and Rajaram J., Chemistry in Engineering and Technology". Vol.1 & 2, 5th reprint, Tata McGraw Hill, Publishing Company (P) Ltd., 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 Questions of 2 Marks each-No choice****20 Marks****PART B : 2 Questions from each unit of internal choice, each carrying 16 Marks.****80 Marks**

(Out of 100 Marks, maximum of 10% problems may be asked.)

SCY 4217	ALLIED CHEMISTRY LAB – I	L	T	P	Credits	Total Marks
	(Allied for B.Sc., Mathematics, Bio, Physics Department students only)	0	0	3	2	100

COURSE OBJECTIVES

- To understand the basics of chemistry laboratory
- To understand and correlate the theory with laboratory

LIST OF EXPERIMENTS

1. Estimation of Total hardness of water sample by EDTA method.
2. Estimation of glycine by Sorenson method
3. Estimation of Ferrous ion by potentiometric method.
4. Determination of pH of a strong acid using pH meter
5. Estimation of mixture of acids by conductometric method.
6. Determination of molecular weight of unknown solute
7. Estimation of Fe by photocolourimeter
8. Estimation of Nickel in a Nickel-Steel alloy

REFERENCES

1. Vogel's Text Book of Inorganic Qualitative Analysis, 4th ed., ELBS, London, 1974.
2. Inorganic lab manual by S.Mumazuddin, Shailendra Kumar Sinha. 2009.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCY 1111	GENERAL CHEMISTRY-I	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To understand the theoretical aspects of volumetric analyses.
- To understand the nature of bond in a given compounds.
- To understand the nomenclature of organic molecules.
- To develop the habit of handling analytical data.
- To study the gas laws and its applications

UNIT 1 ANALYTICAL METHODS-I**12 Hrs.**

Safety and hygiene in the Chemistry Lab Storage and handling of chemicals, first aid procedure. Error in chemical analysis Accuracy and precision, Absolute and relative errors. Methods of eliminating or minimizing errors. Precision: mean, median, average deviation and coefficient of variation. Volumetric Analysis: Preparation of standard solutions-normality and molarity - Types of titrations. Requirements for titrimetric analysis. Primary and secondary standards. Limitations of volumetric analysis. Acid-base titrations-types of acid-base titrations-titration curves selection of suitable indicators. Problems.

UNIT 2 IONIC BOND**12 Hrs.**

General characteristic of ionic bond, size effect and radius ratio rule, limitation of radius ratio rule, Lattice energy - Factors affecting lattice energy. Born equation and its application, Born - Haber cycle application of lattice energy, Role of lattice energy and hydration energy, Covalent character of ionic compounds-Fajan's rules, effects of polarization and polarizability, Crystal structure of AX₂ type.

UNIT 3 COVALENT BOND**12 Hrs.**

General characteristic of covalent bond, Valence Bond theory-arrangement of electrons in molecules, Hybridization and geometry. VSEPR model-Effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity, Illustration of structures by VSEPR. MO theory: LCAO method-criteria of orbital overlap, types of molecular orbitals, qualitative MO energy level diagram of homo diatomic molecules, and their magnetic properties, bond length, bond energy, bond order and stability of molecules.

UNIT 4 CLASSIFICATION AND PROPERTIES OF ORGANIC COMPOUNDS**12 Hrs.**

IUPAC Nomenclature (Monofunctional and polyfunctional) - Shapes of simple molecules - Bond energy, bond length and bond angle - Bond polarity - dipole moment - Bond dissociation energy - Isomerism - Structural and Stereoisomerism - types of isomerism with suitable examples - Concept of hybridization - Structure of organic molecules based on sp³, sp² and sp hybridization - Energy requirements of a reaction - Activation Energy - Transition state - Intermediate - Effect of catalyst on energy of activation.

UNIT 5 GASEOUS STATE**12 Hrs.**

Gas Laws from the kinetic theory of gases. Transport properties - viscosity - thermal conductivity - diffusion - Maxwell's distribution of molecular velocities (no derivation) - mean - rms, most probable, velocity equi-partition of energy - heat capacity - molecular basis - virial equation of state - Boyle temperature - coefficient of compressibility and thermal expansion.

Max. 60 Hrs.**COURSE OUTCOMES**

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

- CO1: Aware of Lab safety and to learn sources and eradication of errors; and to handle, prepare the various laboratory reagents.
 CO2: Learn the periodicity of elements, ionic and covalent character of compounds.
 CO3: Understand the concept of MO energy level diagram.
 CO4: Deal with the concepts of kinetic theory of gases.
 CO5: Understand the IUPAC nomenclature, isomerism and stereochemistry of organic molecules.
 CO6: Gain the knowledge of hybridization.

TEXT / REFERENCE BOOKS

7. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007.
8. Selected topics in inorganic chemistry, [R.D Madan](#), [G.D Tuli](#) & [Wahid U Malik](#), S.Chand publication, 1976.
9. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th ed., Prentice-Hall of India Limited, New Delhi, 1992.
10. Bahl B.S. and ArunBahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).
11. S. H. Pine, Organic Chemistry, 5th ed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
12. B. R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co. 23rd edition, 1993.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each-No choice**PART B:** 2 Questions from each unit with internal choice, each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SCY 4111	VOLUMETRIC ANALYSIS AND INORGANIC PREPARATIONS	L	T	P	Credits	Total Marks
		0	0	3	2	100

COURSE OBJECTIVES

- To bridge the conceptual ideas with practical experiments.
- To promote analytical skills in volumetric analysis.
- To introduce the preparative skills involved in the synthesis of inorganic complexes.

VOLUMETRIC ANALYSIS:

1. Acid – base titrations:

- a. Estimation of HCl.
- b. Estimation of oxalic acid.

2. Redox titrations:

- a. Estimation of Ferrous ammonium sulphates (Permanganometry).
- b. Estimation of KMnO_4 (Iodometry).
- c. Estimation of Copper (Iodometry).

3. Complexometric titration:

- a. Estimation of calcium using EDTA.

INORGANIC PREPARATIONS

- a. Preparation of Ferrous ammonium sulphate.
- b. Preparation of tetraammine copper(II) sulphate.
- c. Preparation of potassium trioxalatoaluminate.
- d. Preparation of potassium trioxalatochromate

COURSE OUTCOMES

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

CO1: Estimate the amount of analyte by acid-base titration.

CO2: Determine the amount of analyte by Redox titration.

CO3: Estimate the amount of calcium by complexometric titration.

CO4: Prepare crystals of Mohr's salt.

CO5: Synthesize crystals of copper salt

CO6: Prepare crystals of oxalato complexes of aluminum and chromium.

TEXT / REFERENCE BOOKS

- 1). S. Sundaram and K. Raghavan, Practical Chemistry, S. Viswanathan Co. Pvt., 1996.
- 2). N. S. Ganapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 2002.
3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry, 5th ed., Pearson Education, 2005.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 50****Exam Duration: 2 Hrs.**

CAE	Evaluation of Regular Lab class	15 Marks	25 Marks
	Model practical exam	10 Marks	
ESE	End Semester Practical exam		25 Marks

2019 REGULATIONS

SCYA 5201	CHEMISTRY OF THE MAIN GROUP ELEMENTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To study the structure and bonding in polyhedral boranes
- To understand the chemistry of Silicon, Sulphur and Phosphorus compounds
- To discuss the synthesis and reactivity of organometallic reagents and macrocycles.
- To study the preparation and properties of various organyls
- To determine the properties and applications of lanthanides and actinides

UNIT 1 CHEMISTRY OF BORANES

12 Hrs.

Structure and bonding in boranes and boron cage compounds- Closo, nido, arachno and carboranes – Styx notation – Wade's rule – Electron count in polyhedral boranes – Synthesis of polyhedral boranes – Isolobal analogy between main group and transition metal fragments– Boron halides – Phosphine-Boron heterocycles – Borazine.

UNIT 2 NON-TRANSITION METAL CHEMISTRY

12 Hrs.

Silanes, silicon halides, silicates, germanes and stannenes – Phosphorous halides, oxyacids of phosphorous, phosphazenes – Sulphur halides, oxo acids of sulphur – Structural features and reactivity of reactivity of S-N heterocycles.

Interhalogen compounds: Structure and properties of interhalogen compounds [ClF, ICl, ClF₃, BrF₃, IF₃, ClF₅, BrF₅, IF₅] poly halides - pseudohalogens [cyanide, thiocyanate and azide] and Xenon compounds.

UNIT3 ORGANOMETALLIC REAGENTS AND MACROCYCLES

12 Hrs.

Synthesis and reactivity of organo-lithium, beryllium and magnesium compounds.

Macrocyclic Ligands: Calixarenes, cryptands and crown ethers-structure and applications in complexation chemistry.

UNIT 4 ORGANYLS

12 Hrs.

Preparation and reactivity of aluminium organyls – Carbalumination, hydroalumination – Chemistry of Ga(I) and In(I) – Reduction of Al, Ga and In organyls – Germanium, tin and lead organyls.

UNIT 5 LANTHANIDES AND ACTINIDES

12 Hrs.

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 - separation of lanthanides, solvent extraction, ion exchange method.

Actinides: actinide series, abundance and natural isotopes, occurrence, preparation of actinides - oxidation states - general properties, the later actinide elements, uranium-occurrence, metallurgy; chemical properties of hydrides, oxides, and halides - complexes of lanthanides and actinides - term symbols.

Max. 60 Hours

COURSE OUTCOME:

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

CO1 - To explain the structure and bonding in polyhedral boranes and borazines and the concept of Styx notation, Wade's rule.

CO2 - To discuss the structural features and reactivity of Silicon, Sulphur, Phosphorous and S-N heterocycles.

CO3 - To determine the synthesis and reactivity of organo lithium, Be and Mg compounds and complexation in calixarines, cryptand and crown ethers.

CO4 - To illustrate the preparation and properties of various organyls and its reduction reactions.

CO5 - To discuss the magnetic and optical properties of lanthanides and actinides.

CO6 - To determine the coordination chemistry of lanthanides and actinides and its applications.

TEXT / REFERENCE BOOKS

1. D. F. Shriver, P. W. Atkins and C.H. Langford, Inorganic Chemistry, Oxford University Press, 1990.
2. J. E. Huheey, E. A. Keiter and R. I. Keiter, Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education, 2004.
3. F. A. Carey, G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry, Wiley Interscience, 2003.
4. C. E. Housecroft and A. G. Sharpe, Inorganic Chemistry, Prentice Hall, 2005.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.

30 Marks

70 marks

SCYA 5202	CHEMICAL KINETICS AND CATALYSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To elucidate the use of chemical kinetics in understanding reaction mechanisms.
- To understand the kinetics of fast reactions.
- To understand adsorption phenomena.
- To enable the learners to understand the importance and significance of heterogeneous catalysis.
- To learn the kinetics of polymerization and experimental methods of determination of molar masses of polymers.

UNIT 1 ADVANCED CHEMICAL KINETICS

12 Hrs.

Thermodynamic formulation of activated complex theory – Theories of unimolecular reactions: Lindemann mechanism – Hinshelwood mechanism – Temperature dependence of pre-exponential factor. Kinetics of reactions in solution: Effect of solvent on reaction rates (reaction between two ions) – Effect of ionic strength on reaction rates: Primary salt effect and secondary salt effect.

UNIT 2 KINETICS OF FAST REACTIONS

12 Hrs.

Chemical relaxation methods: Temperature and pressure jump methods – Reactions in flow systems: Continuous and Stopped flow methods – Shock tube methods – Laser Flash photolysis – Ultrasonic absorption technique.

UNIT 3 KINETICS OF POLYMERIZATION

12 Hrs.

Kinetics of Free radical mechanism, Cationic mechanism and Anionic mechanism – Molar masses of polymers: Number average molecular mass – Weight average molecular mass. Determination of molecular weight of polymers: Light scattering method – Ultracentrifuge method (Sedimentation velocity method).

UNIT 4 ADSORPTION

12 Hrs.

Adsorption isotherms: Types of adsorption isotherm – Langmuir theory of unimolecular layer adsorption isotherm – The BET theory of multimolecular layer isotherm – Determination of surface area of adsorbents – The Gibbs adsorption isotherm equation – Surfactants: Classification of surfactants – Formation of micelles – Critical micelle concentration (CMC) – Thermodynamics of micellization. Emulsions: Hydrophilic-Lipophilic Balance (HLB).

UNIT 5 CATALYSIS

12 Hrs.

Definition of Catalysis – Types of catalysis: homogeneous and heterogeneous. Catalytic kinetics: Concept of Langmuir-Hinshelwood – Photocatalysis using semiconducting oxides: Definition, basic principles and mechanism of photocatalysis – Application of photocatalysis in water remediation, air cleaning – Heterogeneous catalysis by intercalation compounds: Structural aspects of graphite intercalation compounds, catalytic reaction – Kinetics of enzyme catalysis – Lineweaver-Burk plot for the determination of Michaelis constant.

Max. 60 Hours

COURSE OUTCOME:

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

- CO1-** To study thermodynamic and theoretical aspects of chemical kinetics.
- CO2-** To learn the experimental and theoretical aspects of kinetics of fast reaction techniques.
- CO3-** To understand the kinetics of polymerization and learn the methods of determination of molecular mass of polymers.
- CO4-** To learn about surface chemistry and their kinetics.
- CO5-** To understand the importance of surfactants, micelle, and emulsions.
- CO6-** To study the importance of heterogeneous catalysis.

TEXT / REFERENCE BOOKS:

1. Keith J. Laidler, Chemical Kinetics, Pearson Education India, 3rd Edition, 2003.
2. John W. Moore and Ralph G. Pearson, Kinetics and Mechanism, Wiley, 3rd Edition, 1981.
3. Julian R.H. Ross, Heterogeneous Catalysis: Fundamentals and Applications, Elsevier, 1st Edition, 2011.
4. G.C. Bond, Heterogeneous Catalysis: Principles and Application. Oxford University Press, USA, 1987.
5. B. Vishwanathan, S. Sivasankar and A.V. Ramaswamy, Catalysis: Principles and Applications, Narosa Publishing House, New Delhi, 2004
6. C. Kalidas C, Chemical Kinetic Methods, New Age International, 1996.
7. F. Wilkinson, Chemical Kinetics and Reaction Mechanism, Van Nostrand Reinhold Co., 2000.
8. R. Aveyard and D.A Haydon, An Introduction to the Principles of Surface Chemistry, Cambridge University Press, 1973.
9. V.R. Gowarikar, N.V. Vishwanathan and Jayadev Sreedhar, Polymer Science, 2nd Edition, New Age International Publishers, 2006.
10. F.W. Billmeyer, Textbook of Polymer Science, John Wiley & Sons, 3rd Edition, 1990.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.

30 Marks

70 marks

SCYA 5203	FUNDAMENTALS OF STEREOCHEMISTRY AND ORGANIC PHOTOCHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To suggest synthetic route for simple organic compounds with stereochemistry
- To make the students understand and appreciate the concept of stereochemistry and reaction mechanism
- To know the nature of addition in pericyclic reactions
- To learn the alpha cleavage and gamma hydrogen transfer reactions
- To understand the photochemical organic reactions and rearrangement reactions

UNIT 1 STEREOCHEMISTRY-I

12 Hrs.

Elements of symmetry – Chirality – Representation of organic molecules (Fischer, Sawhorse, Newman and Zig-Zag) and their interconversion – Molecules with more than one chiral centre: Erythro and threo isomers – Optical activity in the absence of chiral carbon – biphenyls, allenes and spiranes – Criteria for optical purity – D and L Notation, Cahn-Ingold-Prelog rules – R and S-notations – Absolute and relative configuration Racemic modifications – Racemisation – Thermal, anion, cation, reversible formation – Resolution of racemic modifications – Epimerisation – Mutarotation.

UNIT 2 STEREOCHEMISTRY-II

12 Hrs.

Stereospecific synthesis – Stereochemistry of compounds containing nitrogen, sulphur and phosphorus – Conformational analysis: In acyclic systems – Simple 1,2 disubstituted ethane derivatives – In cyclic systems (cyclobutane, cyclopentane, cyclohexane and cycloheptane) – Conformation and reactivity in disubstituted cyclohexanes – Cis and trans decalins – Topicity of ligands and faces – Enantiotopic and diastereotopic atoms – Prochiral centre and pseudoasymmetry – Stereoselective reactions – Cram's rule and Felkin-Ahn's modification – Prelog's rule.

UNIT 3 PERICYCLIC REACTIONS

12 Hrs.

Characteristics – Types of pericyclic reactions – electrocyclic, cycloaddition, cheletropic and sigmatropic reactions – Woodward Hoffmann rules; The Mobius and Huckel concept, FMO method and Correlation diagrams – Electrocyclic reactions of conjugated dienes and trienes – Cycloaddition and Cheletropic reactions [2 + 2] and [4 + 2] cycloadditions – Diels Alder and Retro Diels Alder reactions – 1, 3-dipolar cycloaddition – Sigmatropic rearrangements involving hydrogen and carbon migration – Cope and Claisen rearrangements.

UNIT 4 ORGANIC PHOTOCHEMISTRY-I

12 Hrs.

Organic photochemistry – General principles – Frank-Condon principle – Electronic transitions – Jablonski diagram: Inter-system crossing and Energy transfer – Photochemistry of carbonyl compounds: $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$ transitions – alpha cleavage or Norrish type I reaction – Gamma hydrogen transfer or Norrish type II reaction - Energy transfer reactions – Sensitizer and Quencher.

UNIT 5 ORGANIC PHOTOCHEMISTRY-II

12 Hrs.

Photoreduction – Paterno-Buchi reactions – di-pi-methane rearrangement – Barton rearrangement – Photo-Fries rearrangement - photochemistry of α, β -unsaturated ketones – Olefin photochemistry (Cis-Trans isomerism) – Photochemistry of conjugated dienes – Photochemistry of arenes and benzene derivatives – Cycloaddition of benzene to olefins and dienes.

Max. 60 Hours

COURSE OUTCOME:

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

- CO1- Understand the various symmetry elements and representation of organic molecules and their interconversion
- CO2- Apply the D and L notation, R and S notation, absolute and relative configurations to organic molecules
- CO3- Explain the conformational analysis of acyclic and cyclic systems
- CO4- Explain the mechanism of various pericyclic reactions such as electrocyclic, cycloaddition, cheletropic and sigmatropic reactions and understand the concept of Woodward Hoffmann rules, The Mobius and Huckel concept and FMO method
- CO5- Discuss the Frank-Condon principle and Jablonski diagram and apply the α -cleavage or γ -hydrogen transfer mechanism to organic molecules
- CO6- Illustrate the mechanism of various photochemical reaction and rearrangement with suitable examples.

TEXT / REFERENCE BOOKS

1. E. L. Eliel, Stereochemistry of Carbon Compounds, Tata-McGraw Hill, 14th Reprint Edition, 1990.
2. P. S. Kalsi, Stereochemistry: Conformation and Mechanism, New Age International Publishers, 8th Edition, 2015.
3. J. March and M. Smith, Advanced Organic Chemistry, John-Wiley and Sons, 7th Edition, 2013.
4. F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry Part-A and B, Kluwer Academic/Plenum Publishers, 5th Edition, 2008.
5. G. B. Gill and M. R. Wills, Pericyclic Reactions, Chapman Hall, 1974.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.

30 Marks

70 marks

SCYA 6201	ORGANIC CHEMISTRY LAB-I	L	T	P	Credits	Total Marks
		0	0	4	2	100

Course Objectives

- To enable the student to develop analytical skill in organic qualitative analysis
- Systematic identification of compounds containing one or more functional groups.
- Systematic identification of mixtures containing two compounds:
- Separation and identification simple binary mixtures having acidic, basic and neutral components .Preparation of their derivatives.

Course Contents

Separation of mixtures containing two compounds with one or more functional groups
Preparation of derivatives for the identified compounds and determine their melting points.

COURSE OUTCOME:

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

C01- Understand the systematic identification of mixtures containing two compounds

C02- Separation and identification simple binary mixtures having acidic, basic and neutral components by chemical methods

C03- Preparation of the identified compound derivatives

C04- Recognize the chemical reactions in identifying the chemical compounds

C05- Identify the compounds containing one or more functional groups

C06 - Acquire the separation skills for binary mixtures

TEXT / REFERENCE BOOKS

1. Gurtu J. N., and Kapoor R., Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.
2. Vogel's Textbook of Practical organic chemistry, ELBS/Longman, 1984.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 50

Exam Duration: 6 Hrs

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCYA 6202	INORGANIC CHEMISTRY LAB-II	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES:

- To learn the theoretical basis of qualitative inorganic analysis
- To understand the method of identification of group and cations using semi-microanalysis
- To gain knowledge about systematic semi-microanalysis

Course Contents

Semi-micro qualitative analysis of mixtures containing two common and two rare cations

COURSE OUTCOME:

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

- C01-** Develop practical skills in inorganic qualitative analysis
C02- Understand the concept of systematic identification of metal cation as their compounds
C03- Recognize the classification of various cations under different groups
C04- To analyze the mixture using semi-microanalysis
C05- To identify the common and rare cations in the mixture
C06- To acquire the group separation skills

TEXT / REFERENCE BOOKS

1. V. V. Ramanujam, Inorganic semimicro qualitative analysis, The national publishing company, Chennai, India, 3rd edition, reprinted 2008.
2. G. H. Jeffery, J. Bassett, J. Mendham and R. Denney, Vogel's Textbook of Quantitative chemical analysis, Pearsons Education, 6th Edition, 2004.
3. I. M. Kolthoff and E. B. Sandell, Text Book of Qualitative Inorganic Analysis, The Macmillan Company, 3rd edition, 1956.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 50

Exam Duration: 6 Hrs

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCYA 5301	ORGANIC REACTION MECHANISM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To learn the various types of bonding and conjugation in organic compounds
- To apply the concept of Huckel rule to determine the aromaticity of compounds
- To know the concept of stability and reactivity of reactive intermediates
- To understand the mechanism of nucleophilic and electrophilic substitution reactions
- To appreciate the concept of substitution, addition and elimination reactions and their reaction mechanism

UNIT 1 NATURE OF BONDING IN ORGANIC MOLECULES

12 Hrs.

Nature of Bonding in Organic Molecules, Delocalized chemical bonding – Conjugation, cross-conjugation, hyperconjugation and hydrogen bonding. Aromaticity. Benzenoid and nonbenzenoid compounds. Huckel and Craig rules. Application of Huckel's rule for annulenes, heteroannulenes, fullerenes, cyclopropenium cation, cyclopentadienyl anion, cycloheptadienyl cation, Homo- and antiaromaticity, Ψ -aromaticity Energy levels of π molecular orbitals, FMO approach.

UNIT 2 REACTION MECHANISM – REACTIVE INTERMEDIATES

12 Hrs.

Field effects (inductive, electromeric effects), mesomerism, resonance, steric effects. Types of reactions and mechanism. Generation, structure, stability and reactivity of carbocations, carbanions and free radicals. Structure of carbenes, nitrenes and benzynes.

UNIT 3 ELECTROPHILIC AND NUCLEOPHILIC ALIPHATIC SUBSTITUTION REACTIONS

12 Hrs.

Aliphatic Nucleophilic substitution: Types of nucleophiles – attacking nucleophile, ambident nucleophiles, hard and soft Nucleophiles. SN^1 , SN^2 and SN^i mechanisms. Neighbouring group participation, anchimeric assistance. Nucleophilic substitution at allylic, aliphatic trigonal and vinylic carbon. Nucleophilicity and solvent effects, Competition between nucleophilicity and basicity, leaving group effects, steric substituent effects on substitution. Aliphatic Electrophilic substitution: Mechanisms - SE^2 and SE^i , SE^1 , Substitution by double bond shifts. Effect of substrates, leaving group and solvent polarity on the reactivity.

UNIT 4 ELECTROPHILIC AND NUCLEOPHILIC AROMATIC SUBSTITUTION REACTIONS

12 Hrs.

Aromatic Electrophilic Substitution: The arenium ion mechanism, orientation and reactivity, Ortho/para ratio, ipso attack, orientation in naphthalene ring systems. Diazonium coupling, Gattermann-Koch reaction.

Aromatic Nucleophilic Substitution: Mechanisms: $SNAr$, SN^1 and Benzyne mechanisms. - Reactivity, Effect of structure, leaving group and attacking nucleophile. Typical reactions: O and S-nucleophiles, Bucherer reaction and Rosenmund reduction and Smiles rearrangements.

UNIT 5 ADDITION AND ELIMINATION REACTIONS

12 Hrs.

Addition to C-C Multiple Bond: Mechanism of addition of HX (X=Halo, OH) to alkenes and alkynes – Micheal addition Addition to Carbon-Hetero Atoms Multiple Bonds –Nucleophilic addition of carbonyl compounds. Addition - Elimination Reactions of Ketones and Aldehydes, Reactivity of carbonyl compounds towards Addition. Elimination Reactions: The E1, E1cB and E2 mechanism, Syn elimination, Orientation Effects in Elimination. Reactions - Pyrolytic eliminations, Chugaev reaction.

Max. 60 Hours

COURSE OUTCOME:

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

CO1- Understand the various types of bonding and conjugation in organic molecules and concept of aromaticity, anti-aromaticity and non-aromaticity

CO2- Apply the Huckel rule for benzenoid and non-benzenoid compounds

CO3- Learn the stability and reactivity of carbocations, carbanions and free radicals and concept of NGP, Field effects.

CO4- Explain the mechanism of aliphatic nucleophilic and electrophilic substitutions such as SN^1 , SN^2 and SN^i mechanism and SE^2 and SE^i , SE^1 , Substitution by double bond shifts

CO5- Discuss the mechanism of aromatic nucleophilic and electrophilic substitutions such as arenium ion mechanism, orientation, reactivity and $SNAr$, SN^1 and Benzyne mechanisms

CO6- Illustrate the addition to C-C multiple bond, Carbon-Hetero atoms multiple bonds with suitable examples and explain the mechanism of Elimination reactions such as E1, E1cB and E2 mechanism

TEXT / REFERENCE BOOKS

1. J. March and M. Smith, Advanced Organic Chemistry, John-Wiley and Sons, 7th Edition, 2013.
2. F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry Part-A and B, Kluwer Academic/Plenum Publishers, 5th Edition, 2007.
3. R. Morrison and R. Boyd, Organic Chemistry, Allyn & Bacon, 2nd Edition, 1967.
4. R. K. Bansal, Organic Reaction Mechanism, New Age International Pvt. Ltd. Publishers, 4th Edition, 2014.
5. S. H. Pine, Organic Chemistry, McGraw Hill International Edition, 5th Edition, 1987.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 6 Questions each carrying 5 marks without choice

30 Marks

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

70 marks

(Out of 100 marks, maximum of 10% problems may be asked)

SCYA 5302	ADVANCED INORGANIC CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To learn about organometallic compounds in terms of structure and bonding including dinitrogen and dioxygen as ligands.
- To understand various synthesis methods of different types of organometallic compounds and to learn their reactivity with mechanism.
- To learn about different reactions involving organometallic compounds as catalysts in chemical synthesis.
- To understand the role of metals and their complexation in the formation of biological compounds like enzymes and their application in medicinal chemistry.
- To learn different types of nuclear reactions with radioactive techniques and to know the applications of radio isotopes in different fields.

UNIT 1 ORGANOMETALLIC COMPOUNDS

12 Hrs.

EAN Rule - Valence electron count (16/18 electron rules) – concept of hapticity - Structure and bonding of mono and heteroleptic metal carbonyls – dinitrogen and dioxygen as ligands in organometallic compounds - Infrared spectra of metal carbonyls – Metal clusters – Low and high nuclearity clusters – clusters having interstitial atoms - Isolobal analogies - Metallocenes and bent metallocenes.

UNIT 2 SYNTHESIS OF ORGANOMETALLIC COMPOUNDS

12 Hrs.

Types of M-C bonds – structure and bonding of metal alkyls, alkenes, allyl, alkynes and arenes - Ligand dissociation and substitution - Oxidative addition - Reductive elimination - Nucleophilic displacement – Insertion - Alkyl migration – 1, 2 insertion - Hydride elimination.

UNIT 3 ORGANOMETALLIC CATALYSTS

12 Hrs.

Terminology in catalysis: Turnover, Turnover number (TON), Turnover frequency (TOF). Homogeneous catalysis – Hydroformylation - Monsanto acetic acid process - Hydrogenation by Wilkinson's catalyst - Wacker (Smidt) process - Olefin metathesis - Heterogeneous catalysts – Ziegler Natta polymerization - Water gas reaction.

UNIT 4 BIOINORGANIC CHEMISTRY

12 Hrs.

Transition metal ions in biology. Active site structure and functions of dioxygen binding heme (hemoglobin and myoglobin) and non-heme (hemocyanin and hemerythrin) proteins. Characterization of coordinated O₂ species in oxy forms of heme and non-heme proteins by resonance Raman spectroscopy. Bohr effect. Electron transfer proteins: Active site structure and functions of cytochromes, and iron-sulphur proteins. Significance of electron transfer proteins in photosynthesis (Z scheme). Coenzyme F430, carboxypeptidase, carbonic anhydrase, vitamin B₁₂, ferritin and transferrin. Mechanism of action of cytochrome P450 and urease. Therapeutic uses of cisplatin, and radioisotopes (Tc, Co and Cu). Basic principles of MRI and application of metal (Mn and Fe) complexes as contrast agents. Toxicity of Cd, Hg and Pb in biology with specific examples.

UNIT 5 NUCLEAR CHEMISTRY

12 Hrs.

Terminology, Concept and formulae of Nuclear chemistry; Radioactivity, Types of particles, Radioactive decay, Radioactive decay constants, equilibrium, Nuclear reactions; Q – Value, Chemical effects of Nuclear Transformations, Fission and Fusion, stability of Nucleus, Radioactive techniques – Tracer technique, Neutron activation analysis, counting technique – G.M. ionization, Proportional counter. Application of Radioisotopes.

Max. 60 Hours

COURSE OUTCOME:

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

- CO1-** Identify organometallic compounds based on EAN rule and to elaborate on the different types of substituted carbonyl compounds.
- CO2-** Interpret the structure, reactivity and significance of organometallic compounds with dinitrogen and dioxygen as ligands.
- CO3-** Analyze the mechanism involved in various ligand dissociation and substitution reactions of organometallic compounds.
- CO4-** Analyze the role of organometallic compounds in various catalysis processes which are of commercial use.
- CO5-** Understand the role and importance of metals in forming biomolecules based on complexation and their application in biotransformation.
- CO6-** Identify different particles in nuclear fission and fusion reactions and to evaluate the application of different radioactive isotopes.

TEXT / REFERENCE BOOKS

1. C.E. Housecroft and A.G. Sharpe, Inorganic Chemistry, 4th Edition, Pearson, 2012.
2. B. D. Gupta and A. J. Elias, Basic Organometallic Chemistry: Concepts, Synthesis, and Applications, 2nd Edition, Universities Press (India), 2013.
3. J. E. Huheey, E. A. Keiter, R.L. Keiter and O.K. Mehdi, Inorganic Chemistry, Principles of Structure and Reactivity, Pearson, 2006.
4. F. A. Carey, G. Wilkinson G., C.A. Murillo and M. Bochmann, Advanced Inorganic Chemistry, Wiley Interscience, 2003.
5. J. Lippard and J.M. Berg, Principles of Bioinorganic Chemistry, University Science Books, 1994.
6. W. Kaim, B. Schwederski and Axel Klein, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life (An introduction and Guide), 2nd Edition, John Wiley & Sons, 2013.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

Exam Duration : 3 Hrs.

30 Marks

70 marks

(Out of 100 marks, maximum of 10% problems may be asked)

SCYA 5303	ELECTROCHEMISTRY AND SOLID STATE CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To understand theories of inter-ionic interactions and to learn the concept of activity coefficient.
- To study the structure of electrical double layer, and to learn electrochemical kinetics.
- To learn electroanalytical techniques.
- To introduce and give an insight into the fascinating area of solid state chemistry and material science.
- To know the preparative methods of solids.

UNIT 1 IONICS

12 Hrs.

Debye-Hückel theory of interionic attraction – Debye-Huckel limiting law – Debye-Huckel-Onsager theory of electrolytes: Asymmetry effect and Electrophoretic effect – Variation of conductance with applied potential: Wein effect and Debye-Falkenhagen effect – Concept of activity coefficient: Mean activity coefficient – Ionic strength.

UNIT 2 ELECTRODICS AND ELECTROANALYTICAL TECHNIQUES

12 Hrs.

The structure of electrical double layer: Helmholtz, Gouy-Chapman and Stern models – Kinetics of electrode reactions: Derivation of Butler Volmer equation – Tafel equation – Polarography: The Ilkovic equation – Half wave potential – Cyclic voltammetry for redox system – Amperometric titrations – Ion selective electrodes: Glass membrane electrode – Solid membrane electrode – Liquid membrane electrode.

UNIT 3 CRYSTAL STRUCTURE

12 Hrs.

Crystalline and amorphous solids – Crystal systems – Bravais lattices – Miller indices – Limiting radius ratio for trigonal, tetrahedral, octahedral and cubic configurations – Methods of characterizing solids: Principle of Powder x-ray diffraction, electron and neutron diffraction.

UNIT 4 CRYSTAL DEFECTS AND NONSTOICHIOMETRY

12 Hrs.

Types of Defect: Point Defects – Schottky Defect – Frenkel Defect – Thermodynamics of Schottky and Frenkel Defect Formation – Solid Electrolytes: Fast-Ion Conductors – Applications of Solid Electrolytes in Batteries, Fuel cells, Oxygen sensor – Vacancies and Interstitials in Non-Stoichiometric Crystals: Extrinsic and Intrinsic Defects – Superconductivity: High Temperature Superconductors: Cuprate Superconductors – Iron Superconductors.

UNIT 5 PREPARATIVE METHODS OF SOLIDS

12 Hrs.

Wagner reaction mechanism for solid state synthesis for spinel – Chemical precursor method for perovskite – Sol-gel method for silica aerogel synthesis – Self-propagating high temperature synthesis – Ion exchange reactions – Intercalation / deintercalation reactions – Methods of Single Crystal Growth: Hydrothermal method of synthesis – Czochralski method.

Max. 60 Hours

COURSE OUTCOME:

- CO1-** To understand the theories and applications of electrochemistry.
CO2- To learn electrode kinetics and the structure of electrified interfaces.
CO3- To know the techniques like polarography, cyclic voltammetry, ion selective electrodes, amperometry.
CO4- To study the basic concept of solid state chemistry.
CO5- To understand the importance of crystal defects, nonstoichiometry
CO6- To learn the various preparative methods crystalline solids.

TEXT / REFERENCE BOOKS

1. J.O.M. Bockris and A.K.N. Reddy, Modern Electrochemistry 1: Ionics, Springer, 2nd Edition, 1998.
2. O.M. Bockris and A.K.N. Reddy, Modern Electrochemistry 2A: Electrodics, Springer, 2nd Edition, 1998.
3. Samuel Glasstone, An Introduction to Electrochemistry, Reed Books, 2007.
4. Allen J. Bard, Larry R. Faulkner, Electrochemical Methods: Fundamentals and Applications, John Wiley & Sons, 2nd Edition, 2001.
5. H.V. Keer, Principles of the Solid State, Wiley Eastern Limited, 1993.
6. D.K. Chakrabarty, Solid State Chemistry, New Age Publishers, 1996.
7. L.E. Smart, E.A. Moore, Solid State Chemistry: An Introduction, CRC Press, 4th Edition, 2012.
8. Sandra E Dann, Reactions and Characterization of Solids, RSC, 2000.
9. A.R. West, Solid State Chemistry and Its Applications, Wiley, 2nd Edition, 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.

30 Marks

70 marks

SCYA 7301	APPLICATIONS OF SPECTROSCOPY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the principles of Molecular Spectroscopy.
- To apply the principles of UV-Visible, IR, NMR and Mass spectroscopy
- To know the application of spectroscopy to study the structure of molecules
- To elucidate the structures of simple organic molecules using the given spectral data.
- To interpret spectra of various spectroscopic techniques.

UNIT 1 ELECTRONIC SPECTROSCOPY

12 Hrs.

Electronic transitions (185-800 nm) – Beer-Lambert law – Effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Fieser-Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic and heterocyclic compounds. Electronic spectra of inorganic and coordination compounds: Charge transfer and d-d transitions, electronic spectra of transition metal halides and oxo compounds.

UNIT 2 IR SPECTROSCOPY

12 Hrs.

Principle, Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies. Study of isomerism: linkage isomerism in coordination compounds-cyano and isocyno-thiocyanato- and isothiocyanato complexes.

UNIT 3 ¹H NMR AND ¹³C SPECTROSCOPY

12 Hrs.

General introduction and definition – Chemical shift, spin-spin interaction, shielding and deshielding mechanism and measurement, chemical shift values and correlation for protons bonded to carbon complex spin-spin interaction between two, three, four and five nuclei (first order spectra), spin system-Pople notation, virtual coupling. Hindered rotation, Karplus curve – variation of coupling constant with dihedral angle. Fourier transform technique. Further tools for simplification (chemical and instrumental) and elucidation of structures by NMR. Carbon-13 NMR Spectroscopy – General considerations, chemical shift – coupling constants. nuclear overhauser effect (NOE).

UNIT 4 MASS SPECTROMETRY

12 Hrs.

Principle of Mass spectra - Representation of Mass spectrum, Molecular ion – types of ions in mass spectra. Effect of isotopes on mass spectra – Determination of molecular formula – McLafferty rearrangement- ortho effect- Meta stable ions – Doubly charged ion – Nitrogen rule – General fragmentation modes – Mass spectra of hydrocarbons – Alkanes, cycloalkanes, alkene, alkynes, aromatic hydrocarbons, alcohols and thiophenols.

UNIT 5 ESR AND MÖSSBAUER SPECTROSCOPY

12 Hrs.

ESR Hyperfine splitting: hyperfine splitting in isotropic systems involving one nucleus and more than one nucleus, hyperfine splitting caused by quadrupole nuclei. Anisotropic systems: anisotropy in g-value, factors causing anisotropy. EPR spectra of systems with more than one unpaired electrons: zero-field splitting, causes of ZFS, ZFS and EPR transitions, EPR spectrum of triplet naphthalene and highspin Mn(II) complexes.

Principles of Mössbauer spectroscopy: Doppler shift, recoil energy, experimental technique- sources, absorber, calibration. Applications of Mossbauer spectroscopy: isomer shift, quadrupole splitting, magnetic interactions; magnetic and quadrupole splitting in ferromagnetic ⁵⁷Fe compounds, Mossbauer spectra of high and low-spin Fe(II) and Fe(III) compounds, site symmetry of metal centers in iron complexes, differentiation of nonequivalent metal centers in polynuclear complexes, discovering oxidation states-Sn, Sn(II), Sn(IV) compounds. Problems pertaining to known and unknown simple organic and inorganic compounds by using UV, IR, Mass and NMR spectroscopy.

Max. 60 Hours

Course Outcomes

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

- CO1:** Identification Of λ_{max} Value Of Inorganic and Organic Compounds.
CO2: Explains – how to identify the functional group of molecules using IR Spectral data.
CO3: Demonstrate the processes responsible for NMR chemical shifts and splitting patterns
CO4: Identification and Ionization of Mass spectra of a given organic molecule using Mc-Lafferty rearrangement.
CO5: To demonstrate application of ESR hyperfine splitting and Mossbauer spectroscopy.
CO6: Evaluating experimental tools to obtain information to confirm or reject a reaction mechanism

TEXT / REFERENCE BOOKS

1. Banwell C. N and McCash E. M., Fundamentals of Molecular Spectroscopy, 4th Edition, Tata McGraw Hill, New Delhi, 2000.
2. Silverstein R. M and Webster F. X., Spectroscopic Identification of Organic Compounds, 6th Edition, John Wiley & Sons, New York, 2003.
3. Levine I. N., Molecular Spectroscopy, John Wiley & Sons, New York, 1974.
4. Williams D. H and Fleming I., Spectroscopic Methods in Organic Chemistry, 4th Edition, Tata McGraw-Hill Publishing Company, New Delhi, 1988.
5. Kemp W., Applications of Spectroscopy, English Language Book Society, 1987.
6. J. A. Weil, J. R. Bolton and J. E. Wertz, Electron Paramagnetic Resonance; Wiley Interscience: 1994.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.

30 Marks

70 marks

SCYA 7302	SYNTHETIC ORGANIC CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

- To learn the methods involved in determining the mechanism of an organic reaction.
- To understand the significance of stereo, enantio, regio and chemo selectivity in chemical reactions.
- To recognize the strategies involved in asymmetric synthesis.
- To impart an insight into specific asymmetric reactions like aldol, hydrogenation, hydroformylation and Reformatsky reaction.
- To emphasize on the importance of organometallic reagents in organic synthesis.

UNIT 1 MECHANISMS AND DETERMINATION METHODS

12 Hrs.

Types of Mechanisms and Reactions - Thermodynamic and Kinetic requirements of a reaction - Representation of Potential Energy Changes in Reactions - General relationship between Thermodynamic stability and Reaction Rates - Kinetic vs thermodynamic control - Methods of Determining Mechanisms: Identification of Products, Determination of the presence of Intermediates, the study of catalysis, Isotopic labeling, Stereochemical Evidence, Kinetic Evidence - Isotope effects.

UNIT 2 STEREO, ENANTIO, REGIO, CHEMO SELECTIVE REACTIONS

12 Hrs.

Introduction: Enantiomeric excess, Diastereomeric excess, Enantioselective Reactions: Hydrogenation, Reduction of ketones, Epoxidation of Allylic alcohols, Dihydroxylation of alkenes – Stereo selective and Stereo specific reactions with suitable examples – Hydroboration - Regioselectivity with examples - The Use of acetylenes – Diastereoselectivity - Cram's Rule - Chemoselectivity in Oxidizing and Reducing agents, dissolving metal reductions, and Catalytic hydrogenation.

UNIT 3 ASYMMETRIC SYNTHESIS – I

12 Hrs.

Introduction to Asymmetric Synthesis – General strategies for asymmetric synthesis - "Chiron" approaches – Acyclic Diastereoselective approaches – Double asymmetric synthesis – Asymmetric Oxidations: Asymmetric Epoxidation of Allylic Alcohols: Sharpless Epoxidation - Selective opening of 2, 3 epoxy alcohols by metallic hydride and organometallic reagents - Asymmetric Diels Alder Reaction: Intramolecular and Retro Diels Alder Reaction.

UNIT 4 ASYMMETRIC SYNTHESIS –II

12 Hrs.

Asymmetric Reformatsky Reactions - Double Asymmetric Cycloaddition – Asymmetric aldol reactions –Aldol reactions – Substrate controlled aldol reactions – Reagent controlled aldol reactions – Chiral catalyst controlled aldol reactions – Double Asymmetric aldol reactions – Asymmetric Transfer Hydrogenation - Asymmetric Hydroformylation.

UNIT 5 REAGENTS IN ORGANIC SYNTHESIS

12 Hrs.

Reagents: Organo-Zinc compounds, Organo-Copper compounds, Organo-lead compounds, Organo- silicon compounds and Organo-cadmium compounds.

Max. 60 Hours

Course Outcomes

On completion of the course the student will be able to

- CO1: Categorize and analyze the mechanism involved in basic organic reactions.
- CO2: Solve the organic reactions with respect to stereo, enantio, regio and chemoselectivity.
- CO3: Propose a strategic reaction pathway in synthesizing a chiral product.
- CO4: Predict the products in asymmetric aldol, hydrogenation reactions
- CO5: Solve the asymmetric hydroformylation and Reformatsky reactions.
- CO6: Choose and predict the organometallic reagents in organic reaction

TEXT / REFERENCE BOOKS

1. Clayden, Greeves, Warren and Wothers., Organic chemistry, 2nd Edition, Oxford University, 2012.
2. J. March's Advanced Organic Chemistry Reaction, Mechanisms and Structure, Wiley 2007.
3. Guo-Qiang Lin, Yue-Ming Li, Albert S.C. Chan., Principles and applications of Asymmetric synthesis, John Wiley 2001.
4. Finar I. L., Organic Chemistry, 6th Edition, Pearson Education Asia, 2004.
5. Carey F. A., and Sundberg R. J., Advanced Organic Chemistry Part-A and B, 5th edn, Springer Publishers 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.

30 Marks

70 marks

SCYA 5101	ORGANIC SYNTHESIS AND RETROSYNTHETIC METHODS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the strategies involved in designing a chemical reaction.
- To recognize the importance of oxidizing and reducing agents in functional group conversion reactions.
- To comprehend the name reactions of alkyl halide and functional groups with their mechanism.
- To learn the significant organic name reactions applied in industries with their mechanism.
- To highlight on importance of molecular rearrangement in organic chemistry.

UNIT 1 ORGANIC SYNTHESIS

12 Hrs.

Synthetic analysis and planning: Retrosynthetic analysis – Synthetic equivalent – Synthons, Rethon – control of stereochemistry – Linear, convergent and divergent syntheses – Use of protecting groups in hydroxyl and carbonyl compounds: different protection and deprotection methods.

UNIT 2 REAGENTS IN ORGANIC CHEMISTRY

12 Hrs.

Oxidation reagents: Potassium permanganate, HIO_4 , OsO_4 , MnO_2 – Alcohol to carbonyls: Cr (VI) oxidants, PCC, 1,3-dithiane – Swern oxidation, Silver carbonate, Prevost and Woodward oxidation, Oxidation of allylic – C-H bonds: DDQ, SeO_2 . Reducing reagents: LAH, NaBH_4 , DIBAL, Electrophilic metal hydrides: BH_3 , AlH_3 . Functional group transformations: Use of organo-lithium compounds – Lithium diisopropyl amide (LDA), RMgX and Tri-N-butyltinhydride, Phase transfer catalysts – Crown ethers and Merrifield resin, Baker yeast.

UNIT 3 NAMED REACTIONS

12 Hrs .

Appel reaction – Corey-Chaykovsky reaction; Stork; Arbuzov reaction - Horner-Wadsworth Emmons reaction - Mannich reaction- Robinson annulation - Stork enamine reaction - Michael addition - Nef reaction - Barton reaction - Henry reaction - Stetter reaction - Sharpless asymmetric epoxidation Grubb's metathesis reaction –Vilsmeier- Haack reaction- Bischler-Napieralski reaction.

UNIT 4 METAL CATALYSED NAMED REACTIONS

12 Hrs .

Mukaiyama reaction - Suzuki Coupling – Stille coupling –Negishi coupling- Hiyama Coupling - Kumada coupling - Fukuyama coupling - Heck reaction- Trost- Tsuji coupling - Sonogashira reaction- Wacker reaction - Buckwald Hetwig reaction – Pauson - Khand reaction - Kulivikovich reaction - Miyaura borylation reaction.

UNIT 5 MOLECULAR REARRANGEMENT

12 Hrs .

General mechanistic considerations: Types of rearrangement by nature of migration – Intra and Inter molecular rearrangement – Cross over experiment. C-C Migration: Pinacol-Pinacolone, Wagner-Meerwein, Demjanov, Benzil-Benzilic acid, Favorski rearrangements. C-N migration: Neber, Arndt-Eistert synthesis, Beckmann, Hofman, Curtius, Schmidt rearrangements. C-O migration: Bayer-Villiger, Shapiro reaction. Miscellaneous: Fries, Cope, Sommelet Hauser, Stevens, Von-Richter rearrangement.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: Construct a single step retrosynthetic pathway for organic reaction
- CO2: Interpret the products in organic chemical reactions involving oxidizing and reducing reagents.
- CO3: Construct and predict the reaction mechanism for name reactions outlined.
- CO4: Formulate chemical reactions and mechanism for name reactions outlined.
- CO5: Design chemical reaction based on molecular rearrangements outlined
- CO6: Design and predict the products in organic reactions.

TEXT / REFERENCE BOOKS

1. March J., and Smith M., Advanced Organic Chemistry, 5th Edition, John-Wiley and Son, 2001.
2. Gould E. S., Mechanism and Structure in Organic Chemistry Holt, Rinehart and Winston Inc., 1959.
3. Carey A. Francis, and Sundberg J Richard., Part A and Part B Advanced Organic chemistry, 5th edition, Springer, 2007.
4. Jonathan Clayden, Nick Greeves and Stuart Warren., Organic Chemistry, 2nd Edition, Oxford Publishers, 2012.
5. Finar I. L., Organic Chemistry, 6th Edition, Pearson Education Asia, 2004.
6. House H.O., Modern Synthetic Reactions, W.A. Benjamin Inc, 1972.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 6 Questions each carrying 5 marks without choice

30 Marks

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

70 marks

(Out of 100 marks, maximum of 10% problems may be asked)

SCYA 5102	COORDINATION CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To know the nature of metal-ligand bonding in coordination compounds and quantification of the bonding parameters.
- Learn the various bonding theories in coordination chemistry and their application in understanding spectra and magnetism.
- Understand Reaction Mechanism in Coordination Chemistry
- To be able to describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters
- To Understand and interpret the spectrum of the metal complexes

UNIT 1 THEORIES OF COORDINATION COMPOUNDS

12 Hrs.

Introduction to Werner's Coordination theory and its postulates, Defects of Werner's theory, Problems based on Werner's theory, Sidgwick's electronic concept of coordination, EAN rule, Defects of Sidgwick's theory, problems based on Sidgwick's theory. Valence bond theory, Spin-only magnetic moment, Hybridization schemes for the bonding frameworks of different geometrical configurations of ligand donor atoms, Defects of the VBT. Problems based on VBT.

Isomerism in coordination complexes - Optical isomerism in coordination complexes. Circular dichroism and optical rotatory dispersion. Racemization in coordination complexes: Ray-Dutt twist and Bailor twist mechanisms. HSAB-principle.

UNIT 2 THEORIES OF COORDINATION COMPOUNDS-II

12 Hrs.

Crystal Field Theory and its postulates, shapes of d-orbitals, crystal field splitting of d-orbitals in different geometries like octahedral – Square planar – Square pyramidal – Trigonal bipyramidal-Pentagonal bipyramidal, Square antiprismatic and tetrahedral complexes. Measurement of 10Dq. Factors affecting the magnitude of 10 Dq. Determination of CFSE, consequences of CF splitting, calculations of crystal field stabilisation energy for d¹ to d¹⁰. Oh systems – Pairing energy – Low-spin and high-spin complexes and magnetic properties. Effect of ligand field on color of the complexes, Jahn-Teller distortions and its consequences with copper system as example. Limitations of crystal field theory. Ligand field theory, and molecular orbital MO diagrams with and without metal-ligand π bonding in an octahedral and tetrahedral complex.

UNIT 3 SPECTRAL AND MAGNETIC PROPERTIES OF COORDINATION COMPOUNDS

12 Hrs.

Introduction, types of absorption spectra, Quantum numbers, Spin-spin coupling, orbit-orbit coupling, spin-orbit coupling, Ground state term Symbols for d¹⁻¹⁰ electron systems, selection rules for electronic transitions in complexes, spin selection rule, Laporte selection rule, Micro states, Correlation diagrams – Orgel and Tanabe – Sugano diagrams for Oh complexes, The nephelauxetic effect, Racah parameters, Electronic spectrum of d¹⁻¹⁰ systems of Oh and Td complexes, Charge transfer spectra of L to M and vice versa. Magnetic properties of metal complexes and spin only formula, determination of magnetic susceptibility – Gouy method, spin and orbital contribution to magnetic moments, The effects of temperature on μ_{eff} , and spin crossover.

UNIT 4 REACTIONS MECHANISMS OF COORDINATION COMPOUNDS

12 Hrs.

Labile and Inert complexes, VBT explanations of lability and Inertness, Ligand substitution reaction, SN¹ – Dissociative mechanism, SN² – Associative mechanism, SN¹ Conjugate base mechanism anation reaction, electron transfer reactions, Outer-sphere – Tunnelling mechanism, Inner-sphere mechanism, Isomerisation reactions –involving Geometrical and optical isomers. Substitution reaction in square planar complexes, Trans effect series, applications of trans effect.

UNIT 5 STABILITY OF COORDINATION COMPOUNDS

12Hrs.

.Thermodynamic stability and kinetic stability, step-wise stability constants and overall stability constants and its relationship, trend in K values, Irving – Williams series, Factors affecting the stability of coordination compounds – Charge and size of central metal ion, Nature of ligand, Basicity and chelating ability of the ligands, steric effect, stereochemical requirements of ligands. Determination of stability constants – solubility method, Ion-exchange method, electrochemical method, spectrophotometric method.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand the structure, isomerism and bonding in coordination complexes.

CO2: Deduce the crystal field splitting diagram for different geometries.

CO3: Characterize the electronic spectra of metal complexes based on correlations diagrams.

CO4: Evaluate the mechanistic pathway of metal complexes.

CO5: Determine the stability of metal complexes using conventional methods

CO6: Interpret the spectrum of different metal complexes with different geometries.

TEXT / REFERENCE BOOKS

1. Catherine E.House Croft and Alan G.Sharpe, Inorganic Chemistry, Pearson, 5th Edition, 2012.
2. Gopalan R., Ramalingam V., Concise Coordination Chemistry, Vikas Publishing House Pvt. Ltd.,2017.
3. Huheey J. E., Keiter E. A., and Keiter R. L., Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education, 2006.
4. Atkins P. W., Overton T., Rourke J., Weller M., and Armstrong F., Shriver & Atkins: Inorganic Chemistry, 4th Edition, Oxford University Press, 2006.
5. Cotton F. A., Wilkinson G., Murillo C. A., and Bochmann M., Advanced Inorganic Chemistry, 6th Edition, Wiley, 1999.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 6 Questions each carrying 5 marks without choice

30 Marks

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

70 marks

(Out of 100 marks, maximum of 10% problems may be asked)

SCYA 5103	THERMODYNAMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To construct second law of thermodynamics, concept of entropy and Carnot cycle.
- To determine the methods for fugacity, activity and activity coefficients.
- To understand the partition function for distinguishable and indistinguishable molecules.
- To derive the various statistical approach and free energy functions of mono and diatomic gases.
- To learn the Onsager theory and applications of irreversible thermodynamics to biological and non-linear systems.

UNIT 1 CLASSICAL THERMODYNAMICS - I

12 Hrs.

Need for the second law – Concept of entropy – Carnot cycle – Gibbs function – Gibbs – Helmholtz equation – Clausius – Clapeyron equation – Thermodynamics of systems of variable compositions – Partial molar quantities, partial molar volume – Chemical potential, Gibbs – Duhem equation – Third law of thermodynamics. Ellingham diagram and its significance.

UNIT 2 CLASSICAL THERMODYNAMICS – II

12Hrs.

Thermodynamics of real gases and real solutions: Fugacity: Methods of determination. Dependence on temperature, pressure and composition. Activity and activity coefficient – Determination of activity and activity coefficient of non-electrolytes and electrolytes. Solubility of ionic solids in water – Solubility curves – Ternary system involving water and two soluble ionic solids – Formation of double salts.

UNIT 3 STATISTICAL THERMODYNAMICS – I

12Hrs.

Phase space – Ensembles: Different types of ensembles – Micro canonical, canonical and grand canonical – Distinguishable and indistinguishable molecules – Maxwell-Boltzmann statistic – Partition function and thermodynamic functions – Separation of partition function – Translational, rotational, vibrational and electronic partition functions. Statistical approach to thermodynamic properties - Internal energy, entropy, enthalpy, Helmholtz function, pressure, Gibbs function, residual entropy, equilibrium constant.

UNIT 4 STATISTICAL THERMODYNAMICS - II

12 Hrs.

Quantum Statistics Bose-Einstein statistics – Fermi-Dirac statistics – Free energy function Heat capacity of mono and diatomic gases. Ortho- and para hydrogen and mixture of the two viz., ortho H₂ and para H₂ – Heat capacity of solids – Einstein and Debye models – Sackur-Tetrode equation.

UNIT 5 NON EQUILIBRIUM THERMODYNAMICS

12 Hrs.

Near equilibrium process: General theory – Conservation of mass and energy – Entropy production in open system by (i) heat (ii) matter and (iii) current flow – Onsager theory: Validity and verification – Application of irreversible thermodynamics to biological and non-linear systems.

Max. 60 Hours

COURSE OUTCOME:

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

CO1: Construct the Second law of thermodynamics for explaining the concept of entropy and to derive Carnot cycle and various Gibbs functions.

CO2 : Determine the methods for fugacity, activity and activity coefficient of electrolytes and non-electrolytes.

CO3 : Derive the various partition functions in statistical approach.

CO4 : Discuss the Bose-Einstein and Fermi-Dirac statistics and heat capacity of solids.

CO5 : Explain the conservation of mass and energy and entropy production in open systems.

CO6 : Discuss the Onsager theory validity and verification.

TEXT / REFERENCE BOOKS

1. P. R. Rastogi and R. R. Misra, An Introduction to Chemical Thermodynamics, 6th Revised Edition, Vikas Publishing House Ltd., 2009.
2. P. W. Atkins, Physical Chemistry, Oxford University Press, 1978.
3. S. Glasstone, Thermodynamics for Chemists, Affiliated East-West Press, 1974.
4. I. M. Klotz and R. M. Rosenberg, Chemical Thermodynamics: Basic Theory and Methods, 18th Edition, Benjamin/Cummings Pub. Co., 1986.
5. R. P. Rastogi and R. R. Misra, Classical Thermodynamics, Vikas Publishing House Ltd., 1990.
6. J. Rajaram and J. C. Kuriakose, Thermodynamics, 3rd Edition, S. Chand & Co., 1999.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 6 Questions each carrying 5 marks without choice

30 Marks

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

70 marks

(Out of 100 marks, maximum of 10% problems may be asked)

SCYA 5104	ANALYTICAL CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To learn the basic analytical principles of AAS
- To gain knowledge about working principle of separation techniques
- To understand the basic concepts of TGA/DSC
- To know the basic principles involved in electroanalytical techniques
- To study the concepts of various spectrometric analytical techniques

UNIT 1 ATOMIC ABSORPTION SPECTROSCOPY

12 Hrs.

Atomic absorption spectroscopy: Principle, instrumentation, the nebuliser - burner system, graphite tube furnace, resonance line source, monochromators, detectors, and spectral and chemical interferences - determination of calcium and magnesium in water and determination of tin in canned fruit juices.

Flame Spectrometry: Principle, instrumentation and interferences determination of alkali metals.

UNIT 2 SEPARATION TECHNIQUES

12 Hrs.

Chromatographic separation: Gas chromatography: Principle – instrumentation – Detectors: Flame ionisation detector – Photo ionisation detector and ECD – Application of GC using mass spectrometry – Liquid Chromatography: Types – Application of LC using mass spectrometry - HPLC: Principle – Instrumentation – Advantages of HPLC. Electrophoresis: Principle – Instrumentation – Capillary electrophoresis and detector, Gel electrophoresis.

UNIT 3 THERMAL METHODS OF ANALYSIS

12Hrs.

Introduction to thermal analysis: TG and DTG – Static thermogravimetry and dynamic thermogravimetry: Instrumentation – Thermogram – Factors affecting thermograms – Application of thermogravimetry – Reaction kinetics: Kinetics by single and multiple heating rates. Differential thermal analysis: DTA theories – DTA curves – Factors affecting DTA curves – Instrumentation – Applications of DTA – Simultaneous determination in thermal analysis. Correlation of DTA and TGA data with examples – Thermal decomposition of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ – DSC: Introduction – Principle – Instrumentation and Application of DSC.

UNIT 4 ELECTROANALYTICAL METHODS

12Hrs.

Electrogravimetry: Principle, instrumentation, deposition and separation. Electrolysis at constant current and estimation of copper. Coulometry: Principle, controlled potential coulometry and separation of nickel and cobalt, coulometric titration, instrumentation - Estimation of Sb(III).

Potentiometry: Principle, potentiometric titration, equivalence point potential for (i) Fe^{2+} - Ce^{4+} system (ii) Fe^{2+} - MnO_4^- / H^+ system, determination of concentration of the species at the equivalence point. Ion selective electrodes, solid state ion selective detectors, Biochemical electrodes.

UNIT 5 SPECTROMETRY

12 Hrs.

Spectrophotometry: Beer Lambert's law - significance of molar extinction coefficient, photoelectric photometer, spectrophotometric titration, determination of Fe (III) with EDTA and determination of Fe (III) in the presence of aluminium.

Turbidimetry: Principle, instrumentation - determination of sulphate and phosphate

Fluorimetry: Principle, relationship between excitation spectra and fluorescence spectra, factors affecting fluorescence emission, instrumentation - determination of quinine in tonic water and determination of codeine and morphine in a mixture.

Max. 60 Hours

COURSE OUTCOME:

- CO1:** Explain the principle, instrumentation and working of AAS and Flame photometry.
- CO2:** Understand the basic concepts of Chromatographic techniques.
- CO3:** Analysis and interpretation of TGA/DSC curves
- CO4:** Understand the basic principles and interpretations of electroanalytical techniques.
- CO5:** Apply the principles of Beer's law for the determination of ions.
- CO6:** Understand the basic concepts of analytical techniques.

TEXT / REFERENCE BOOKS

1. J. M. Hollas, Modern Spectroscopy, John Wiley & sons, 4th Edition, 2004.
2. H. H. Willard, L. L. Merritt, J. A. Dean and A. F. Settle, Instrumental methods of analysis, 6th Edition, Van Nostrand, 1984.
3. D. A. Skoog, D. M. West, F. J. Holler and S. R. Crouch, Fundamentals of Analytical Chemistry, Wadsworth Publishing Co. Inc., 9th Edition, 2012.
4. R. D. Braun, Introduction to Instrumental Analysis, McGraw-Hill, 1987.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.

30 Marks

70 marks

SCYA 5105	QUANTUM CHEMISTRY AND GROUP THEORY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To have a good foundation in understanding the physical and mathematical aspects of quantum mechanics
- To understand the basic concepts of postulates of quantum mechanics
- To study the fundamental principles of quantum chemistry, Schrodinger wave equation and its applications
- To learn the approximation methods to Helium and Hydrogen molecule ion
- To study the elements of group theory and the applications of group theory

UNIT 1 BASICS OF QUANTUM MECHANICS

12 Hrs.

Black-body radiation – Planck's law of radiation – Photoelectric effect – Compton effect – wave particle duality – de-Broglie's hypothesis – Heisenberg's uncertainty principle – Bohr's theory and its limitations – Classical waves and wave equation for electrons. Operators – Linear operators, Commutator algebra – Evaluation of commutators, Hermitian operators and its properties – Eigen value and Eigen function – Momentum – Hamiltonian operator – Postulates of quantum mechanics.

UNIT 2 APPLICATION OF QUANTUM MECHANICS

12 Hrs.

Derivation of Schrodinger wave equation – Orthogonality and normalization of wave functions – Characteristics of wave function. Application of SWE to free particle, particle in one dimensional box and three dimensional box – Simple harmonic oscillator – Rigid rotor – ladder operator – Angular momentum operator. Schrodinger equation for hydrogen – Significance of quantum numbers – shapes of atomic orbitals – spin angular momentum.

UNIT 3 APPROXIMATION METHODS

12 Hrs.

Need for approximation methods – Approximation methods - perturbation and variation methods and their application to Helium atom – Born - Oppenheimer approximation – Hydrogen molecule ion – Huckel- π -electron theory and its applications to ethylene and butadiene.

UNIT 4 GROUP THEORY

12 Hrs.

Group and Subgroup –Symmetry elements and operations – Determination of point groups of representative molecules/complexes - Symmetry point groups – Vector and matrix algebra – Matrix representation of Symmetry operations – Reducible and irreducible representations – Great orthogonality theorem – Characters – Construction of a character tables– C_{2v} , C_{3v} , C_{2h} , D_{2h} .

UNIT 5 APPLICATION OF GROUP THEORY

12 Hrs.

Determination of representation of vibrational modes in non- linear molecules such as H_2O , CH_4 and NH_3 – symmetry of Hybrid orbitals in non- linear molecule (BF_3 , CH_4 , NH_3) – Symmetry selection rules of infra-red and Raman spectra – application of group theory for the electronic spectra of ethylene and formaldehyde.

Max. 60 Hours

COURSE OUTCOME:

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

- CO1:** Understand the various laws of radiation and principle that explain the basics of quantum mechanics
CO2: Apply the quantum mechanical treatment to derive the various quantum mechanical operators
CO3: Derive the wave function and energy of particle in 1D and three-dimensional box, Simple harmonic oscillator, Rigid rotor and hydrogen atom
CO4: Explain the Born - Oppenheimer approximation and apply the Perturbation and variation methods to Helium atom
CO5: Construct the character table of C_{2v} , C_{3v} , C_{2h} point groups and explain the Great Orthogonality theorem
CO6: Determine the representation of vibrational modes and symmetry of hybrid orbitals in non- linear molecules

TEXT / REFERENCE BOOKS

1. A. K. Chandra, Introductory Quantum Chemistry, Tata Mc Graw Hill Publishing Co., 4th Edition 1994.
2. R. K. Prasad, Quantum Chemistry, New Age International Publishers, Revised 3rd Edition, 2006.
3. H. L. Strauss, Quantum Mechanics, Prentice Hall, 1972.
4. P. W. Atkins and R. S. Friedman, Molecular Quantum Mechanics, Oxford University Press, 5th Edition, 2010.
5. H. Eyring, J. Walter and G. E. Kimball, Quantum Chemistry, John Wiley & Sons, 1944
6. F. A. Cotton, Chemical Applications of Group Theory, John Wiley & Sons, 3rd Edition, 1999.
7. K. V. Raman, Group Theory and its Applications to Chemistry, Tata McGraw-Hill, 3rd Edition, 1990.
8. V. Ramakrishnan and Gopinath, Group Theory in Chemistry, Vishal Publications, 2nd Edition 2013.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.

30 Marks

70 marks

SCYA 6101	PHYSICAL CHEMISTRY LAB – I	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES:

- To know about the practical applications of conductometry.
- To learn concepts of potentiometry and pH metry.
- To apply the basic concept of chemical kinetics and adsorption studies.
- To gain practical knowledge in the synthesis of nanomaterials.

The list of probable experiments is mentioned below, which delineates the experiment to be performed in a semester. Any seven experiments can be selected from the list.

List of Experiments

1. Verification of Ostwald dilution law and determination of dissociation constant of weak acids.
2. Effect of ionic strength on reaction rate.
3. Study of kinetics of second order reaction by conductometric method.
4. Determination of equivalent conductance of a strong electrolyte (NaCl, KCl) at several concentrations and hence verify Debye Huckel Onsager equation.
5. Determination of equivalent conductance of a weak electrolyte (CH_3COOH) at infinite dilution by Kohlrausch's law.
6. Intercalation of sodium into vanadium oxide and potentiometric estimation of extent of intercalation.
7. Comparison of the strength of ferrous ammonium sulphate solution by potentiometric titration and by conventional titrimetric method.
8. Determination of first, second and third dissociation constants of phosphoric acid.
9. Determination of dissociation constants of a weak acid.
10. Verification of the Freundlich and Langmuir adsorption isotherms for adsorption of acetic acid/oxalic acid on activated charcoal.
11. Synthesis of Cd-Te nanoparticles and study quantum confinement

COURSE OUTCOME:

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

CO1- To develop practical skills in conductance measurements.

CO2- To develop practical skills in emf measurements.

CO3- To understand to determine dissociation constants for mono and multi basic acids.

CO4- To understand experimental knowledge on kinetics.

CO5- To gain experimental knowledge on surface chemistry.

CO6- To gain experimental knowledge on the synthesis of nanoparticles at room temperature.

TEXT / REFERENCE BOOKS:

1. Carl Garland, Joseph Nibler and Schoemaker, Experiments in Physical Chemistry, Mcgraw-Hill College, 7th Edition, 2003.
2. D.V. Jahagirdan, Experiments in Chemistry, Himalaya Publishers House, 2003.
3. Arthur, Halpern and George McBane, Experimental Physical Chemistry, Freeman, 2006.
4. Yadav, Advanced Practical Physical Chemistry, Goel Pub, 1994.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 50

Exam Duration: 6 Hrs

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SCYA 6102	INORGANIC CHEMISTRY LAB-I	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES:

- To improve the skill in quantitative estimation of metal ions.
- To identify the methodology for the quantitative separation and estimation of mixture of metal ions.
- To improve the skill in preparation of metal complexes in good yield under suitable conditions with appropriate starting materials.

Course Contents

ESTIMATION

Estimation of Cu-Zn

Estimation of Fe-Mg

Estimation of Fe-Ni

Estimation of Cu-Ni

PREPARATION OF COMPLEXES

thiourea copper(I) sulphate

dioxalato diaquachromate(III)

tris(thiourea) copper(I) chloride

hexammine nickel(II) chloride

bis(acetylacetonato) copper(II) sulphate

COURSE OUTCOME:

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

CO1- Quantitatively estimate metal ions in the presence of other ions by titration and gravimetric methods.

CO2- Identify the qualitative method for the quantitative separation of metal ions from a mixture of metal ions.

CO3- Develop skill in preparation of inorganic metal complexes by the selection of suitable starting materials in good percentage yield.

CO4- Understand the mechanism and structural details of the prepared complexes.

CO5- Characterization of some of the prepared complexes by spectroscopic analysis.

CO6- Assessment of purity of the prepared complexes from the spectroscopic data.

TEXT / REFERENCE BOOKS

1. Jeffery G. H., Bassett J., Mendham J., and Denney R. C., Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearsons Education, 2004.
2. Kolthoff I. M., and Sandell E. B., Text Book of Qualitative Inorganic Analysis, 3rd Edition, The Macmillan Company; 1956.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 50

Exam Duration: 6 Hrs

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

2019 Regulations

SCYA1102	ENGINEERING CHEMISTRY	L	T	P	Credits	Total Marks
		3	1	0	3	100

COURSE OBJECTIVES:

- To understand the basic concepts of quantum chemistry for bonds to bands
- To learn the principles and applications of energy levels in molecules
- To explore the importance of functional materials for electronic devices
- To study the structure and properties of carbon materials
- To identify the significance of chemistry in engineering and technology

COURSE SYLLABUS:

UNIT 1 BONDS TO BANDS

9 Hrs.

Introduction to quantum chemistry – Motion of a quantum mechanical particle in one dimension (time-independent) – Schrödinger wave equation for hydrogen atom (No derivation) – Physical meaning of wave function - Angular and radial wave functions and probability densities – Quantum numbers – Principal, azimuthal, spin and magnetic quantum numbers – Wave functions and orbital shapes - s, p, d, f - LCAO-MO of H_2 – Band theory of solids: Conductors, semi-conductors and superconductors – Role of As and Ga doping on band structures.

UNIT 2 MOLECULAR SPECTROSCOPY

9 Hrs.

Electromagnetic spectrum – Interaction of radiation with matter – Energy levels in molecules – Microwave spectroscopy – Principle – Classification of molecules based on moment of Inertia – Rotational energy expression (J levels) – Calculation of J for CO molecule – Vibrational spectroscopy – Normal modes of vibrations – Vibrations of polyatomic molecules (CO_2 and H_2O) – Determination of Force constant – Electronic transitions in organic molecules – Mathematical derivation of Beer-Lambert's law – Stimulated Emission – Lasers in action – Excimer laser, Diode laser and Gas laser.

UNIT 3 FUNCTIONAL MATERIALS

9 Hrs.

Introduction to conducting polymers – Charge transport carriers: Exciton formation in organic solar cells and organic light emitting diodes (principle and working) – Conduction mechanism in polymers: Soliton, polaron and bipolaron formation in polyacetylene and polyaniline – Liquid crystals: Characteristic features and phases of liquid crystals – Liquid crystal displays.

UNIT 4 CARBON MATERIALS FOR HEALTH, STEALTH AND ENERGY

9 Hrs.

Introduction to carbon materials – Fullerenes – Production, properties and applications – VanderWaal's solid – Structure of graphene, graphene oxide and reduced graphene oxide – Mechanical and electrical properties of graphene – Graphene based energy storage devices for space applications – Carbon nanotubes – Single-walled and multiwalled CNTs - Synthesis of CNTs by Thermal CVD and laser ablation method – Electrical and mechanical properties of CNTs - Applications of CNTs.

UNIT 5 ENGINEERING MATERIALS

9 Hrs.

Phase equilibria: Gibbs phase rule – Terms involved in Phase rule – Phase diagram of water system – Thermal method of analysis – Construction of simple eutectic system (Lead-Silver system).

Fuels– Classification of fuels – Determination of calorific values of solid fuels by bomb calorimeter– Manufacture of synthetic petrol by Fischer-Tropsch method – Knocking in IC engines – Chemical structure – Octane and cetane rating of fuels.

Nanomaterials: Size dependent properties of nanomaterials – Synthesis of gold and silver nanoparticles by Chemical reduction method–Applications of nanoparticles in medicine.

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Apply the principles of quantum chemistry in conduction mechanism in solids.

CO2: Analyze the spectral transitions of molecules for photonic devices.

CO3: Assess the role of charge transport carriers for functioning of electronic devices.

CO4: Analyze the properties of carbon materials for applications in health, stealth and energy sectors.

CO5: Examine the properties of engineering materials for nanodevice fabrication.

CO6: Evaluate the materials for real world applications.

TEXT / REFERENCE BOOKS

1. A.K.Chandra, Introductory Quantum Chemistry, Tata McGraw-Hill, 4th edition, 1994.
2. Ira N. Levine, Physical chemistry, 6th Edition, 2008.
3. Ira N. Levine, Quantum chemistry, 7th Edition, 2013.
4. David W. Ball and Thomas Baer, Physical Chemistry, Wadsworth Cengage Learning, 2nd Edition, 2014.
5. Donald W. Rogers, Concise Physical Chemistry, John Wiley and Sons, 2011.
6. Douglas A. Skoog and Donald M.West, Principles of Instrumental Analysis, Cengage, 6th Edition, 2014.
7. P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai Publication, 2018.
8. Joel. R. Fried, Polymer Science and Technology, Prentice Hall of India Private Ltd., 3rd Edition, 2012.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. marks:100

Exam Duration:3 Hrs.

Part A: 10 question of 2 marks each – No choice

20 marks

Part B: 2 questions from each unit of internal choice, each carrying 16 marks 80 marks

SCYA 2101	ENGINEERING CHEMISTRY LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

COURSE OBJECTIVES:

- To understand the basic principle involved in volumetric and instrumental analysis.
- To acquire practical knowledge in pHmetry, potentiometry and conductometry.
- To develop the skill in water analysis.

List of Experiments

1. Estimation of mixture of acids by conductometry.
2. Estimation of ferrous ion by potentiometry.
3. Determination of pKa value of glycine by pHmetry.
4. Estimation of hardness of water by EDTA method.
5. Determination of alkalinity of water
6. Estimation of Iron by photolorimetry.
7. Estimation of copper in brass
8. Determination of high molecular weight polymer using Ostwald viscometer.

COURSE OUTCOME:

The students will be able:

CO1 - Estimate the ionic conductance of mixture of acids.

CO2 - Construct a redox cell and measure its emf.

CO3 - Interpret the concept of Zwitter ion in amino acids

CO4 - Predict the quality of water sample for domestic and industrial applications.

CO5 - Demonstrate the validity of Beer-Lambert's law.

CO6 - Apply Poiseuille's law for molar mass measurements.

TEXT / REFERENCE BOOKS

1. G.H. Jeffery, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition. Persons Education 2004.
2. S. S. Dara, Experiments and Calculations in Engineering Chemistry, S. Chand and Co. 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. marks:50

Exam Duration:2 Hrs

CAE	Evaluation of Regular Lab class	15 Marks	25 Marks
	Model practical exam	10 Marks	
ESE	University Practical exam		25 Marks