

SCHOOL OF SCIENCE AND HUMANITIES
DEPARTMENT OF CHEMISTRY

1.1.2 Revised Courses and New Courses Introduced During 2023-2024

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Minutes of BOS-June 2023

Department of Chemistry

Minutes of the BOS Meeting-2023 meeting held on 11th July, 2023 at 11.30 A.M. Department of Chemistry, Sathyabama Institute of Science and Technology, Chennai.

Members Present:

S.No.	Name of the Staff	Members	Signature with seal
1.	Dr.J.Karthikeyan, (Professor) Head - Chemistry	Convener	J. Karthikeyan
2.	Dr.P.Bhyrappa, (Professor) Dept.of Chemistry, IITM.	BOS member	P. Bhyrappa
3.	Dr.V.Subramanian, (Chief Scientist) Inorganic & Physical Chemistry, CLRI, Chennai.	BOS member	V. Subramanian
4.	Dr.V.Kavitha (Professor)	Member	V. Kavitha
5.	Dr.T.Krithiga (Associate Professor)	Member	T. Krithiga
6.	Dr.S.Supriya (Associate Professor)	Member	S. Supriya
7.	Dr.K.Chennakesavalu Reddy (Professor)	Member	K. Chennakesavalu Reddy
8.	Dr.S.Sunitha (Assistant Professor)	Member	S. Sunitha

Absent - NIL

Dr.J.Karthikeyan, Professor & Head, Convener of BOS, during his introductory comments has explained the revised syllabus of Ist year B.E/B.Tech, B.Sc., Chemistry(3 years), B.Sc., Chemistry(HONS)(4 years), M.Sc., Chemistry(2 years), M.Sc., Chemistry(Integrated)(5 years) (2023 Regulation) and also explained the outcomes of the new syllabus, he also explained the new honours degrees program and integrated M.Sc. Program and also highlighted the following points for discussion and approval:

- Bachelor of Degree in Chemistry is awarded with 121 credits. A student with a maximum of CGPA 8 can proceed to Honors Degree in Chemistry at the end of second year, i.e after the completion of 4 semesters, gaining 163 credits at the end of semester 8 for the award of Bachelor of Science - Honors degree in Chemistry. Student can further proceed with Masters in Chemistry by pursuing additionally two semesters 9 and 10, for the award of Integrated M.Sc Chemistry degree.

- After a brief remark, the agenda items listed below were considered for discussion

Points of Revision for UG/PG Courses

SCYB 1101

- Introduced
Unit – 3 Electrochemistry,
Unit – 4 Corrosion Science
Instead of Unit 3 Functional Materials and Unit 4 Carbon materials for health, Stealth and Energy.

SCYB 2101 – No Change in Chemistry Lab

- Dr.P.Bhyrappa and Dr.V.Subraminian, recommended that instead of Engineering Chemistry(Theory) title, members advised us the title “Chemistry” and Engineering Chemistry Lab to “Chemistry Lab” (Common to all branches) processed with the above mentioned correction.

B.Sc Syllabus:

B.Sc., Chemistry syllabus newly introduced courses and approved by our BOS members

1. SCYB 2103 – Environmental Chemistry Lab (Ist – Sem)
2. SCYB 1102 – Basic Chemistry(Exclusively for Clinical Nutrition and Dietics)
3. SCYB 2102 - Basic Chemistry Lab(Exclusively for Clinical Nutrition and Dietics)
4. SCYB 1201 – Industrial Chemistry (Exclusively for B.Tech Chemical Engineering)
5. SCYA 1203 – Principles Chemistry Lab Safety and Management (IInd – Sem)
6. SCYB 1302 – Biochemistry
7. SCYB 2301 – Biochemistry Lab
8. SCYB 4002 – Chemistry in Everyday

Further, all other existing core papers are revised to an extent of 10 – 20 % to meet the market demand and the same is approved by our BOS members, detailed revised syllabus is available in our department website.

M.Sc Syllabus

- Introduced the papers SCYB7001- Bioorganic Chemistry; SCYB7002 – Spectroscopy and SCYB7003 – Photo, Heterocyclic and Pericyclic Chemistry in M.Sc Chemistry course. Further, all other existing core papers are revised for about 10 – 20 % to meet the market demand and the same is approved by our BOS members, detailed revised syllabus is available in our department website.

After a brief discussion, the BOS members gave consent for the changes made with respect to the syllabus, for the following programs.

- SCYA 1101 –Chemistry (Common to all branches of I year BE /B.Tech)
- SCYA 2101- Chemistry Lab (Common to all branches of I year BE/B.Tech)
- B.Sc., Chemistry (3 years), B.Sc., Chemistry(HONS)(4 years), M.Sc., Chemistry (2 years), M.Sc., Chemistry(Integrated)(5 years) syllabus.

Conclusion:

As per recommendation of the BOS members, Integrated M.Sc., Chemistry syllabus has been approved for the academic year 2023 – 2024.

ITEM No: BOS/June 2023:

For Board of council
approval

ITEM No: BOS/June 2023:

For Board of council
approval

J. Kevile Keyson
HEAD OF THE DEPARTMENT
DEPARTMENT OF CHEMISTRY
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
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SCYA 2102 (OLD)	VOLUMETRIC ANALYSIS LAB	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

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

SCYA 2103 (OLD)	PREPARATORY INORGANIC CHEMISTRY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

COURSE OBJECTIVES

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

INORGANIC PREPARATIONS

- a. Preparation of ferrous ammonium sulphate and record the percentage of yield.
- b. Preparation of tetraammine copper(II) sulphate and record the absorption maxima($\lambda_{\max}$) of this complex
- c. Preparation of potassium trioxalatoaluminate and record the percentage of yield.
- d. Preparation of potassium trioxalatochromate and record the percentage of yield.
- e. Preparation of Reinecke's Salt, $[\text{Ni}(\text{en})_3]\text{Cl}_2$ and record the absorption maxima($\lambda_{\max}$) of this complex
- f. Preparation of trithiourea copper(I) sulphate dehydrate and record the absorption maxima($\lambda_{\max}$) of this complex
- g. Studies on composition of complexes in following systems(any two) by Job's and Mole ratio methods
 - (a) Cu(II)-ethylene diamine
 - (b) Fe(III)- sulphosalysilic acid
 - (c) Fe-1,10 phenanthroline compounds

COURSE OUTCOMES

On successful completion of the course,

CO1: Outline the techniques in preparatory inorganic chemistry

CO2: Assess the absorption maxima of the given sample

CO3: Validate the composition of the inorganic complexes.

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

SCYA 2201 (OLD)	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.

COURSE OUTCOMES

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

CO1: Estimate the amount of analyte by gravimetric analysis.

CO2: Apply the mechanism pathway for the single stage synthesis of simple organic compounds

CO3: Evaluate the basic concept of chemistry to real world applications

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

SCYB2202 (REVISED)	GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATIONS LAB	L	T	P	EL	Credits	Total Marks
		0	0	3	0	2	100

COURSE OBJECTIVES

- To understanding the concept of gravimetric analysis
- To learn the chemistry of various organic preparations
- To create new road map for organic synthesis.

LIST OF EXPERIMENTS

1. Estimation of Barium as Barium Chromate.
2. Estimation of Lead as Lead Chromate.
3. Estimation of Nickel as Ni-DMG.
4. Estimation of Calcium as Calcium oxalate.
5. 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.

COURSE OUTCOMES

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

- CO1** - Estimate the amount of analyte by gravimetric analysis.
CO2 - Understand the principles of Ligand to Metal interaction
CO3 - Examine the types of organic reactions in real samples
CO4 - Understand the principles of single stage Organic preparation techniques
CO5 - Apply the mechanism pathway for the single stage synthesis of simple organic compounds
CO6 - Evaluate the basic concept of chemistry to real world applications

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

SCYB1102	BASIC CHEMISTRY	L	T	P	EL	C	Total Marks
		3	0	0	0	3	100

Course Objectives:

- To understand the fundamentals of coordination chemistry and its applications
- To learn the structural aspects of biologically important compounds
- To know the applications of phase rule and freezing mixtures

UNIT I: Coordination Chemistry 9 Hrs

Definition of terms-classification of ligands-Nomenclature-chelation-EDTA and its applications-Werner's Theory-Effective Atomic Number-Pauling's Theory-Postulates-Biological role of hemoglobin and chlorophyll, (Elementary idea only)

UNIT II: Carbohydrates 9 Hrs

Classification, preparation and reactions of glucose and fructose. Interconversion of glucose to fructose and vice versa. Structure of starch. Cellulose and derivatives of cellulose -Diabetes - Causes and control measures.

UNIT III: Proteins 9 Hrs

Amino acids-Classification, Preparation and properties of alanine - Preparation of dipeptide using Bergman method - Proteins -Classification according to composition, biological functions and shape - Denaturation and colour reactions of Proteins - Primary and secondary structure of Proteins nucleic acids: DNA and RNA- Their components and biological functions.

UNIT IV: Fundamentals of Organic Chemistry 9 Hrs

Classification of organic compounds - Hybridization in methane, ethane, ethylene, acetylene, benzene -Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution, elimination, condensation and polymerization

Catalysis

Characteristics of catalytic reaction, auto catalysis, promoters, catalytic poisons - Types of catalysis - homogeneous and heterogeneous - Enzyme catalysis (no derivation, elementary idea only)

UNIT V: Analytical chemistry 9 Hrs

Introduction to Qualitative and Quantitative Analysis - Principle of volumetric analysis - Separation techniques - extraction - distillation - crystallization - Chromatographic separations - Principles and application of column, paper, thin layer.

Max.45 Hrs

Course Outcomes:

On completion of the course, students will be able to

- CO1 Utilize knowledge from basics of chemistry in nutrition.
- CO2 Apply coordination chemistry principles in biochemical reactions.
- CO3 Acquire the knowledge on carbohydrate - structures and classification.
- CO4 understanding protein and its chemical reactions with respect to nutrition.
- CO5 Know in detail about electrolytic reactions and importance of catalysis.
- CO6 Understand thoroughly basis qualitative & quantitative volumetric analysis.

Text / Reference books

1. Gopalan R. and Sundaram S., Allied Chemistry, Sultan Chand & Sons Publishers, New Delhi 2nded.
2. Bahl B.S. and ArunBahl, A text book of Organic Chemistry 21st ed., S. Chand and Company Pvt. Ltd.
3. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th ed., Vishal Publishing Company, 2016.
4. Soni P.L. and Mohan Katyal, Text Book of Inorganic Chemistry, Sultan Chand and Company Pvt. Ltd, New Delhi, 20th ed.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 5 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration: 3Hrs

20 Marks

80 Marks

SCYB1201	INDUSTRIAL CHEMISTRY (For B. Tech.Chemical)	L	T	P	C	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Construct phase diagram for one, two and three component system

CO2: Deduce the molecular weight from the solubility of solutes in liquids and gases

CO3: Assess different separating techniques for chemical system

CO4: Predict the rate of chemical reactions and their mechanism

CO5: Examine the molecular motion in liquids and their applications

CO6: Relate the basic chemistry concepts in science and technology

UNIT	TOPICS COVERED	DURATION
	CHEMISTRY OF TRANSITION METALS Crystal Field Theory – CFSE – Octahedral symmetry – Tetrahedral symmetry – square planar symmetry -factors affecting CFSE – Applications of CFSE – Jahn-Teller distortion (Z in and out case) – consequences – Orgel diagrams (d^1 & d^9 , d^2 & d^8 complex) – electronic spectra of copper complex only- number of peaks - calculation of crystal field parameters for d^3 , d^8 systems – charge transfer spectra. Introduction to Bio-Inorganic Chemistry, Metalloprotein (Hb, Mb, Transferrin) and Metalloenzyme.	9 h
	SOLUTIONS 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.	9 h
	CATALYSIS Introduction- Types of catalysis- Homogeneous catalysis- examples- kinetics; Heterogeneous catalysis- example- kinetics, enzyme catalysis- Michaelis-Menten kinetics- role of catalyst in industrial process- Contact process, Haber's Process, Wacker's Process, Fischer-tropsch process, cracking of hydrocarbons.	9 h
	SEPARATION TECHNIQUES 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).	9 h
	CHEMICAL KINETICS Introduction: First and second order reactions: Integration - Integration of nth order reaction Methods of determining order and molecularity. Collision theory of bimolecular gaseous reactions - Activated complex of bimolecular reactions - Lindemann theory of unimolecular equation - Kinetics of complex reactions: Reversible reaction - Consecutive reaction - Chain reactions - Autocatalysis - Problems.	9 h
	ADVANCED ELECTROCHEMISTRY Introduction: Cell constant - Equivalent conductance - Molar conductance. Ionic mobility: Transport number - Moving boundary method - Hittorff's method. Debye Huckel theory of	9 h

	strong electrolytes. Concentration cells: Types - Concentration cells without transference and with transference. Potentiometric titrations: Redox titration. Polarography - Applications of polarography	
	ORGANIC REACTION MECHANISM Types of Reactions – Reaction Mechanism – Electrophilic substitution reactions in aromatic compounds - mechanisms of nitration - halogenation - sulphonation - Friedel-Craft's acylation and alkylation – Aliphatic nucleophilic substitutions - Mechanisms of SN1, SN2 and SNi reactions - effects of structure of substrate - solvent - nucleophile and leaving groups – Nucleophilic addition reactions – Nucleophilic addition to carbonyl groups	9 h
	INDUSTRIAL APPLICATIONS OF SUBSTITUTION AND ADDITION REACTIONS Industrial Applications of Addition Reactions – Addition reactions of C = C bonds – Hydrogenation of vegetable oil – Hydrogenation of alkene – Hydrohalogenation of alkene Addition reactions of C = O bond – Synthesis of Cyanohydrin – Synthesis of hemi-acetal – Synthesis of alcohols using Grignard reagent – Industrial Applications of Substitution Reactions – Formation of Carbon – Heteroatom bond (C – Cl bond, C – N bond, C – S bond and C – O bond) – Synthesis of Aryl halides – Synthesis of Nitro compound, Synthesis of Aryl Sulphonic acid and Synthesis of paracetamol in pharma industries.	9 h

TEXT / REFERENCE BOOKS

1. Puri B.R., Sharma L. R., Madan. S.Pathania, Principles of Physical Chemistry, 41st Edition , Vishal Publishing co., 2004.
2. Keith J. Laidler, Chemical Kinetics, Third Edition, Pearson education limited, 2004.
3. Atkins P. W., Physical Chemistry, 6th edition, Oxford University press, 1998.
4. Barrow G. M., Physical Chemistry, 5th edition, McGraw-Hill, 1988.
5. Glasstone S., A Text book of Physical Chemistry, Macmillan Ltd, 1976.
6. Jayakumar V., Engineering Metallurgy, ARS publications, 2012

SCYB1203	PRINCIPLES OF CHEMISTRY LABORATORY SAFETY & MANAGEMENT	L	T	P	EL	C	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES:

- To know the safety measures in chemical lab.
- To learn about the safety regulations and safety practices.
- To have knowledge about the preparation of stock and standard solutions.

UNIT-I SAFETY REGULATIONS & SAFETY EQUIPMENTS 9 Hrs.

Standard laboratory procedures, Rules and Regulations. Lab safety practices-Do's and Don'ts, safety plans and arrangement of laboratories-standard operating procedures. Various safety equipment's, User manuals, Training.

UNIT-II CHEMICALS AND BIOSAFETY 9 Hrs.

Chemicals handling- MSDS information - Labelling of chemicals, harmful, low hazard, flammable, toxic, narcotic, oxidizing, lachrymatory, carcinogenic, dangerous when wet, radioactive, gases under pressure, corrosive, explosive and dangerous to the environment. Solid and liquid waste handling and disposal- biochemical safety-radioactive handling and disposal.

UNIT-III FIRST AID 9 Hrs.

First Aid Practices - Cardiac, Chemical injury, Physical injury: Poisons, Cuts/Bleeding, Fire accidents, Chemicals spill on skin and eye accidents and their treatments, Emergency calls and procedure, First Aid Kits.

UNIT-IV ERRORS IN CHEMICAL ANALYSIS 9Hrs.

Errors in chemical analysis - Accuracy and precision, Types of errors - Determinate and indeterminate errors. Precision: mean, median, average deviation. Statistical treatment-standard deviation, variance, confidence limits, application of statistics to data treatment and evaluation, student-t and f tests, detection of gross errors, rejection of a result-Q test, estimation of detection limits. Least square method, correlation coefficient and its determination.

UNIT-V TITRIMETRIC METHODS OF ANALYSIS 9 Hrs.

Methods of expressing concentration of solutions - Molarity, molality, formality, normality, mole fraction, ppm and ppb. Law of volumetric analysis. Types of titrations. Requirements for titrimetric analysis. Primary and secondary standards. Limitation of volumetric analysis. Buffer solutions. Henderson equation. Preparation of acidic and basic buffers. Relative strength of acids and bases from K_a and K_b values. Neutralization-titration curve, theory and choice of indicators. Complexometric titrations - Stability of complexes. Titration involving EDTA.

Max. 45 Hrs

COURSE OUTCOME:

On completion of the course the student will be able to

CO1: Understand the safety measures in the laboratory.

CO2: Analyse the chemical handling and waste management.

CO3: Apply the knowledge of first aid safety procedures in laboratory.

C04: Analyse the errors and standard deviation in experimental results.

C05: Determine the concentration of unknown samples.

C06: Evaluate the safety principles in real world applications

TEXT / REFERENCE BOOKS

1. Introduction to Health and Safety at work, Elsevier 2015.
2. Environmental Health & safety Procedure Manual, Harper College, 2001.
3. Analytical Chemistry, 6th Edition, John Wiley & Sons, 2007.
4. Principles of Instrumental methods of analysis, 2017.
5. Vogel's text book of qualitative analysis.

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.)

SCYB2102	BASIC CHEMISTRY LAB	L	T	P	EL	C	Total Marks
		0	0	3	0	2	100

Course Objectives:

1. To understand the basic concepts of Organic Chemistry.
2. To study the Qualitative and Quantitative Analysis.
3. To learn the functional groups of organic chemistry

I. Volumetric Analysis

1. Estimation of Sodium hydroxide using standard Sodium Carbonate.
2. Estimation of Hydrochloric acid using standard Oxalic acid.
3. Estimation of calcium from calcium tablets using EDTA

II. Systematic analysis of Organic compounds

The analysis must be carried out as follows

- a) Functional group tests - Carboxylic acid, Benzoic acid, phthalic acid, Phenol, Urea, Glucose, Benzaldehyde, Aniline
- b) Detection of elements (N, S, Halogens)
- c) Distinguish between aliphatic and aromatic
- d) Saturated and unsaturated compounds

Course Outcomes:

On completion of the course, students will be able to

- CO1: Acquire Quantitative skills in volumetric analysis.
- CO2: Develop the skill in analyzing special elements present in the organic substances.
- CO3: Evaluate the aliphatic and aromatic nature of the organic substances.
- CO4: Identify the different functional group present in the organic substances.
- CO5: Estimate the analytes present in samples.
- CO6: Determine the functional group of food materials.

Book/ Textbook References

1. Basic Principles of Practical Chemistry, Venkateswaran, Veerasamy& Kulandaivel S Chand &Co.
2. Gopalan R. and Sundaram S., Allied Chemistry, Sultan Chand & Sons Publishers, New Delhi 2nd ed.
3. Soni P.L. and Mohan Katyal, Text Book of Inorganic Chemistry, Sultan Chand and Company Pvt. Ltd, New Delhi, 20th ed.
4. Bahl B.S. and Arun Bahl, A text book of Organic Chemistry 21st ed., S. Chand and Company.

SCYB2104	VOLUMETRIC & PREPARATORY INORGANIC CHEMISTRY LAB	L	T	P	EL	Credits	Total Marks
		0	0	3	0	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. 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: Estimation of oxalic acid.
6. Redox titrations: Estimation of Ferrous ammonium sulphates (Permanganometry).
7. Determination of Copper by Iodometry

INORGANIC PREPARATIONS

1. Preparation of Tetra amine copper(II) sulphate and record the $\lambda_{\max}$ for the prepared complex
2. Preparation of Potassium trisoxalato chromate (III) trihydrate and record the $\lambda_{\max}$ for the prepared complex
3. Preparation of Potassium trisoxalato aluminate (III) trihydrate and record the $\lambda_{\max}$ for the prepared complex
4. Preparation of $[\text{Ni}(\text{en})_3]\text{Cl}_2$ complex and record the $\lambda_{\max}$ for the prepared complex.
5. Preparation of trithio urea Copper(I) sulphate dihydrate and record the $\lambda_{\max}$ for the prepared complex.

COURSE OUTCOMES

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

- CO1** - Apply safety protocols in chemistry laboratory
CO2 - Interpret the statistical parameters in quantitative analysis
CO3 - Quantitative skills in volumetric analysis..
CO4 - Outline the techniques in preparatory inorganic chemistry
CO5 - Assess the absorption maxima of the given sample
CO6 - Validate the composition of the inorganic complexes.

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: 100

Exam Duration: 3 Hrs.

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

SCYB2103	ENVIRONMENTAL CHEMISTRY LAB	L	T	P	EL	Credits	Total Marks
		0	0	3	0	2	100

COURSE OBJECTIVES

- To understand the basics of environmental chemistry through water analysis
- To understand and correlate the theoretical environmental issues with fundamental experiments
- To understand the basic knowledge in environmental samples

LIST OF EXPERIMENTS

1. Determination of p^H and p^{OH} of a water sample by p^H metry
2. Determination of alkalinity of a water sample using acid base indicators
3. Estimation of Temporary, Permanent and Total hardness of a water sample by EDTA method
4. Estimation of available chlorine in a water sample by iodometry method
5. Determination of COD of a waste water sample
6. Estimation of Total Dissolved Solids and Total Suspended Solids in a water sample
7. Estimation of Sulphate content of a water sample by gravimetry
8. Estimation of Ferrous ion by Photocolorimetry

COURSE OUTCOMES

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

- CO1** - Explain the principle behind acidic and basic character of a water sample.
CO2 - Analyze the concept of using indicators in estimating alkalinity of water.
CO3 - Categorize water sample based on hardness.
CO4 - Identify quality of water sample through chlorine content, oxygen demand and dissolved salts.
CO5 - Illustrate the application of basic instrumentation in waste water treatment.
CO6 - Examine the role of metal complexation in water analysis.

TEXT / REFERENCES BOOKS

1. A Laboratory Manual for Environmental Chemistry, I.K. International Publishing, R. Gopalan, Amirtha Anand, and R. Wilfred Sugumar, 2008..
2. Water Analysis Handbook, (2nd Edition), Hach Co., Loveland, 1992.
3. Drinking Water Chemistry: A Laboratory Manual, B.A. Haauser, Lewis publishers, Boca Raton, 2001

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

SCYB1302	BIOCHEMISTRY	L	T	P	EL	Credits	Total Marks
		3	1	0	0	3	100

COURSE OBJECTIVE

- To give an insight into the chemical aspects of biological macromolecules and their importance.
- To create solid foundation in biochemical processes.
- To Provide basic concepts of biochemistry and its nature of interdisciplinary importance.

UNIT 1 CARBOHYDRATES 9 Hrs.

Carbohydrates: Classification, Monosaccharides: -linear and ring forms (Haworth's formula), Structures, Stereoisomers and structural isomers, mutarotation, and chemical properties. Dissaccharides-structure and importance of sucrose, Lactose, maltose, Polysaccharides: - Structure and significance of homopolysaccharides and heteropolysaccharides.

UNIT 2 AMINO ACIDS AD PROTEINS 9 Hrs.

Amino acids: Structures and Classifications, Essential and Non-essential amino acids, amphoteric nature, isoelectric point, zwitter ion.

Protein: Classification - shape, solubility and composition; biological functions of proteins, bonds involved in protein structure, structural levels of organization: - primary, secondary, tertiary and quaternary structures with examples.

UNIT 3 LIPIDS AD NUCLEIC ACIDS 9 Hrs.

Lipids: Classifications, physical and chemical properties of fats, structure and functions of saturated and unsaturated fatty acids.

Nucleic acids: Nitrogenous bases, structures of Ribonucleotides and deoxyribonucleotides, structure and functions of DNA and RNA.

UNIT 4 ENZYMES AND METABOLIC CYCLES 9 Hrs.

Enzymes: IUB classification of enzymes with example. Active site, enzyme units, Enzyme kinetics: - MM equation, factors affecting enzyme activity.

Metabolic cycles: Glycolysis, TCA cycle, Urea cycle

UNIT 5 VITAMINS AND MINERALS 9 Hrs.

Vitamins: fat soluble and water soluble vitamins. Deficiency disorders. Minerals: Micro and Macro minerals. Biological importance of vitamins and minerals.

Max. 45 Hrs.**COURSE OUTCOMES**

- CO1** - To understand about the basic classification and biological significance of carbohydrates.
- CO2** - To have insight on structure, classification and properties of amino acids and to study their impact on organizing the structure of proteins.
- CO3** - To recite the categorization, structure and various functions of lipids and nucleic acids.
- CO4** - To analyze the concept of enzyme activity.
- CO5** - To apply the importance of enzymes in metabolism.
- CO6** - To interpret the vital role of vitamins and minerals

TEXT / REFERENCE BOOKS

1. Lehninger, Nelson and Cox, Principles of Biochemistry, W.H.Freeman, 4th Edition, 2005
2. Donald Voet, Judith Voet and Charlotte Pratt, Principles of Biochemistry, John Wiley and Sons, 2008.
3. Reginald H. Garrett and Charles M. Grisham, Biochemistry, 6th Edition, Brooks Cole publisher, 2017.
4. Harper's Illustrated Biochemistry 31st edition, by Lange Publishers, 2018

5. Biochemistry by U. Sathyanarayana & U.Chakrapani, fifth edition, Elsevier publications, 2018

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

80 Marks

SCYB2301	BIOCHEMISTRY LAB	L	T	P	EL	Credits	Total Marks
		0	0	3	0	2	100

COURSE OBJECTIVE

- To understand and analyze various biomolecules using biochemical methods
- To understand the basic concepts of analysis of biological samples
- To understand the interpretations of real samples.

LIST OF EXPERIMENTS

1. Qualitative Analysis of Carbohydrates
2. Qualitative Analysis of Amino Acids
3. Working Principle And Standardization of Colorimeter
4. Quantitative Estimation of Protein By Lowry's Method.
5. Quantitative Estimation of Urea By Dam Method.
6. Estimation of Ascorbic Acid
7. Determination of Saponification Value of Edible Oil

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1** - Identify carbohydrates and amino acids in various sources
CO2 - Apply the principle and instrumentation of colorimeter
CO3 - Interpret the quantity of protein and urea in samples
CO4 - Apply titrimetry in analyzing vitamins like ascorbic acid
CO5 - Analyze the properties of lipids through their applications
CO6 - Choose appropriate biochemical methods to analyze various biomolecules

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

SCYB4002	Chemistry in Everyday	L	T	P	Credits	Total
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the role of food preservatives and artificial sweeteners.
- To comprehend the essence of colours in fabric
- To examine the function of drugs in human system.

Unit 1: Food Additives**9 Hrs**

Food additives, - Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate. antioxidants (definition and examples, Structure of BHT, BHA and Ajinomoto Flavours: Vanillin, alkyl esters (fruit flavours) and monosodium glutamate. Artificial food colorants: Tartrazine, indigo carmine, sunset yellow, amaranth, allura red

Unit 2 : Dyes**9 Hrs**

Dyes Colour and constitution (electronic concept). Classification of dyes. Methods of applying dyes to the fabrics. Classification of dyes based on applicability on substrates (examples with structures) (a) Acid/basic Dyes, Direct cotton Dyes, Azoic Dyes, Mordant Dyes, Vat Dyes Sulphur Dyes- Sulphur Black T, Disperse Dyes, Reactive Dyes, Optical Brighteners: Stilbene, Heterocyclic vinylene derivatives, Diarylpyrazolines.

Unit 3: Drugs**9 Hrs**

Drugs: Classification and nomenclature. Drug-target interaction Therapeutic action : antacids; Antihistamines Analgesics – aspirin, paracetamol. Anthelmintic drug: mebendazole. Antiallergic drug: Chlorpheniramine maleate. Antibiotics: Penicillin V, Chloromycetin, Streptomycin. Anti-inflammatory agent: Oxyphenbutazone. Antimalarials: Primaquine phosphate & Chloroquine.

Unit 4: Fertilizer**9 Hrs**

Composition of soil – inorganic and organic components in soil-micro and macronutrients. Fertilizers-classification- Nitrogenous, phosphatic and potassic fertilizers Nitrogenous fertilizers: Organic N forms, Synthetic N fertilizers – Manufacturing of urea. Phosphatic fertilizers: P fertilizer sources –preparation of single, triple super phosphate and thermo-phosphate. Potassic fertilizers: K fertilizer – natural sources – manufacturing of potassium nitrate. Complex fertilizers – manufacturing of ammonium phosphates (DAP), nitro phosphates and NPK complexes.

Unit 5: Energy systems**9 Hrs**

Batteries: Primary batteries: Secondary batteries: Lead acid battery, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, sodium-beta and redox batteries. Fuel cells: alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells. Membranes for fuel cells: Nafion – Polymer blends and composite membranes

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Illustrate the role of additives in enhancing the food quality.

CO2: Formulate the dyes for the fabric.

CO3: Evaluate the functions of various drugs in human system.

CO4: Assess the type fertilizer suited for soil.

CO5: Explain the significance of chemical energy systems.

CO6: Appreciate the role of chemistry in various aspects of life.

TEXT / REFERENCE BOOKS

1. B. K. Sharma, Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. N. Shakuntala Many and S. Swamy., Foods: Facts and Principles. 4th ed. New Age International (1998)
3. Drugs and Pharmaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York.
4. Swaminathan and Goswamy., Handbook on Fertilizer Technology, 6th ed. 2001, FAI.
5. P I Atkins and J. de Paula., Physical Chemistry, 7th Edition, Oxford University Press, 2002
6. Finar I. L., Organic Chemistry, 6th Edition, Vol 1 and Vol 2, Pearson Education Asia, 2004.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 10 Questions each carrying 2 marks without 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)

SCYA 5104 (OLD)	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**

SCYB5104 (REVISED)	ANALYTICAL CHEMISTRY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To study the concepts of various spectrometric analytical techniques
- To gain knowledge about working principle of separation & electroanalytical techniques
- To understand the basic concepts of TGA/DSC as thermal methods of analysis

UNIT 1 ABSORPTION SPECTROSCOPY**12 Hrs.**

Atomic absorption spectroscopy - Theory, instrumentation (flame and flameless atomization), Interferences - spectral and chemical - determination of calcium and magnesium in water, estimation of tin in canned food, applications of AAS, Flame Spectrometry - Principle, instrumentation and interferences, determination of alkali metals, applications.

UNIT 2 CHROMATOGRAPHIC TECHNIQUES**12 Hrs.**

General aspects of Chromatography - Gas chromatography: Principle - Types - nature and selection of stationary and mobile phases - solid supports - sampling methods - instrumentation - Detectors: FID - TCD and ECD - qualitative and quantitative applications of GC-MS - Liquid Chromatography: Types - Applications - HPLC: Principle - Theory and equipments - types of pumps and their choice - types of columns - choice of column materials - detectors and applications. Electrophoresis: Principle - Instrumentation - Capillary and Gel electrophoresis.

UNIT 3 THERMAL METHODS OF ANALYSIS**12 Hrs.**

Introduction: TG and DTG - Instrumentation - Thermogram - Factors affecting thermograms - Thermal decomposition study of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ - Applications of thermogravimetry. Differential thermal analysis: Theory - DTA curves - Factors affecting DTA curves - Instrumentation - Applications of DTA - Correlation of DTA and TGA data with examples - DSC: Principle - Instrumentation - Applications of DSC.

UNIT 4 ELECTROANALYTICAL METHODS**12 Hrs.**

Electrogravimetry: Theory - electronegativity - order of deposition - over potential - polarization curves - constant potential and consecutive deposition - selective deposition - constant current deposition and deposition of complex ions - estimation of copper. Coulometry: Principle, Faraday's laws - types of coulometers - coulometric titrations - internal and external generation - coulogravimetry and applications.

Potentiometry: Principle, standard and formal potentials - types of electrodes - Glass membrane and ion-selective electrodes - potentiometric titration based on Fe^{2+} - Ce^{4+} system - Biochemical electrodes.

UNIT 5 SPECTROMETRY**12 Hrs.**

Spectrophotometry: Introduction - Beer Lambert's law - significance of molar extinction coefficient, UV-visible spectrophotometry - photometric titration - Determination Fe(III) involving EDTA as ligand, determination of Fe (III) in the presence of aluminium.

Turbidimetry and Nephelometry: Principle - instrumentation - applications

Fluorimetry: Principles of fluorescence - factors affecting fluorescence emission - instrumentation - applications.

COURSE OUTCOME

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

- 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.
5. J. H. Kennedy, Analytical Chemistry Principles, Saunders College Publishing, New York, II Edition, 1990.

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

80 Marks

SCYA 6101 (OLD)	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

SCYB6101 (REVISED)	PHYSICAL CHEMISTRY LAB I	L	T	P	EL	Credits	Total Marks
		0	0	4	0	2	100

COURSE OBJECTIVES:

- To know about the practical applications of UV-Visible and fluorescence spectrophotometer.
- To understand the construction binary and ternary phase diagrams.
- To gain practical knowledge in electroanalytical techniques.

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

- Study of Solvatochromism effect of coumarin.
- Verification of Ostwald dilution law and determination of dissociation constant of weak acids.
- Solubility curves and phase diagram for a ternary system (e.g. Chloroform-acetic acid-water, ethanol-benzene-water, ethanol-ethylacetate- water, acetic acid-benzene-water).
- Study of Redox reactions for understanding the reversibility of the reaction using cyclic voltammetry.
- Determination of the PI of an amino acid using pH meter.
- Determination of Stern-Volmer constant of an Iodine quenching reaction by fluorimetric method.
- Determination of the formation constant of iron(III) salicylate complex (UV spectroscopy).
- Verification of the Freundlich and Langmuir adsorption isotherms for adsorption of acetic acid/oxalic acid on activated charcoal.
- Determination of relative viscosities of given organic liquids.
- Potentiometric titration of a solution of chloride ion with a solution of silver nitrate.
- Determination of Cell constant - conductometry.

COURSE OUTCOME

- CO1** - Estimation of the equilibrium constant using distribution coefficient.
CO2 - Acquire the knowledge of uv-visible and fluorescence spectrophotometer.
CO3 - Interpretation and construction of phase diagram of binary system and ternary system.
CO4 - Elucidation of practical knowledge of cyclic voltammetry.
CO5 - Execution of relative viscosities of given organic liquids.
CO6 - Determination of Cell constant.

TEXT / REFERENCE BOOKS

- Carl Garland, Joseph Nibler and Schoemaker, Experiments in Physical Chemistry, McGraw-Hill College, 7th Edition, 2003.
- D.V. Jahagirdan, Experiments in Chemistry, Himalaya Publishers House, 2003.
- Arthur, Halpern and George McBane, Experimental Physical Chemistry, Freeman, 2006.
- 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 5202 (OLD)	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,

- C01-** To study thermodynamic and theoretical aspects of chemical kinetics.
C02- To learn the experimental and theoretical aspects of kinetics of fast reaction techniques.
C03- To understand the kinetics of polymerization and learn the methods of determination of molecular mass of polymers.
C04- To learn about surface chemistry and their kinetics.
C05- To understand the importance of surfactants, micelle, and emulsions.
C06- 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**

SCYB5202 (REVISED)	CHEMICAL KINETICS AND CATALYSIS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To evaluate the use of chemical kinetics in understanding reaction mechanisms.
- To estimate the kinetics of fast reactions and effect of temperature on the rate of reaction
- To compile the learners to understand the importance and significance of heterogeneous catalysis.

UNIT 1 ADVANCED CHEMICAL KINETICS**12 Hrs.**

Thermodynamic formulation of activated complex theory – Theories of unimolecular reactions: Lindemann mechanism - Hinshelwood mechanism RRKM and Slater treatment, Application of absolute reaction rate theory (ARRT) to simple bimolecular process, chain reactions, general characteristics, study of kinetics of chain reaction in inorganic reactions (ozone decomposition, H_2-Br_2 reaction), organic reactions (decomposition of acetaldehyde and N_2O_5), and explosive reactions (H_2-O_2). Determination of reaction mechanisms for Hypochlorite-iodide, Acetone-iodine, $CO-Cl_2$, ethylene - hydrogen.

CASE STUDY:

Analyse and demonstrate the order of the reaction between NO_2-F_2 & Ammonium Cyanate-Urea

UNIT 2 KINETICS IN SOLUTION AND FAST REACTIONS**12 Hrs.**

Solvent effects on reaction rates - cage effect, factors determining the reaction rates in solution (based on transition state theory) - reactions between ions - ion-dipole and dipole - dipole reactions - primary and secondary salt effects. Kinetic isotope effects-linear free energy relationships-Hammett and Taft equations.

Fast reactions: Chemical relaxation methods in two step and multi-step synthesis - Temperature and pressure jump methods - electrical field jump method- Reactions in flow systems: Continuous and Stopped flow methods - Shock tube methods - Laser Flash photolysis - Ultrasonic absorption technique - Diffusion controlled reactions - fluorescence quenching - electrochemical methods

CASE STUDY:

Determine the exchange rate of methyl proton in the fast reaction of Proton exchange between N,N-dimethylacetamide and solvent.

UNIT 3 KINETICS IN THE EXCITED STATE**12 Hrs.**

Jablonski diagram - Kinetics of Unimolecular and bimolecular photophysical and photochemical processes - Quantum yield calculation - Excited state lifetime-quenching constant - Resonance energy transfer rates (RET) - Rate and efficiency of RET - Dynamics of electron transfer - Solvent reorganization energy - Marcus theory of electron transfer - Free energy and rate relation - RehmWeller behaviour - Marcus Inverted Region

CASE STUDY:

- Examine and elaborate the theoretical investigation of ground and excited state transition in coumarin based dye in vitamin K.
- Assuming that the equilibrium constant for the reaction is about 100 (favoring the product) and roughly independent of temperature over this range, what is the reorganization energy for this reaction (assume $\Delta G = \Delta G^0$ for this reaction).

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).

CASE STUDY:

- a) Explain the surface science concepts like surface area, particle size, porosity in our kitchen materials.
- b) Explain the effect of surface area and porosity of talcum powder, char coal, tooth paste

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.

CASE STUDY:

- a) Examine and explain the properties of Sn based catalyst alternate for the heavy metal catalysts in the plastics industry.
- b) Analyse the efficiency of highly-active catalysts for the conversion of natural gas to liquid hydrocarbons

Max. 60 Hrs.**COURSE OUTCOME**

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

- CO1** - Examine the thermodynamic and theoretical aspects of chemical kinetics.
- CO2** - Demonstrate the experimental and theoretical aspects of kinetics of fast reaction techniques.
- CO3** - Understand the kinetics of polymerization and learn the methods of determination of molecular mass of polymers.
- CO4** - Analyse the surface chemistry and their kinetics process.
- CO5** - Determine the importance of surfactants, micelle, and emulsions.
- CO6** - Formulate the importance of heterogeneous catalysis

TEXT / REFERENCES BOOKS

1. K.J. Laidler, "Chemical Kinetics", 3rd edn. 1987, Harper and Row Publishers. New York
2. J. Rajaram and J.C. Kuriokose, "Kinetics and Mechanisms of chemical transformation, 1st edn 1993, Macmillan India Ltd, Delhi
3. A.A. Frost and R.G. Pearson, "Kinetics and Mechanism", (2nd edn), 1963, John Wiley and sons INC.
4. K.K. Rohatgi Mukherjee, "Fundamentals of Photochemistry", Revised edition 1978, New Age International Publishers, New Delhi.
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.

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**

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

SCYA 5203 (OLD)	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: $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ 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 an 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

- C01-** Understand the various symmetry elements and representation of organic molecules and their interconversion
C02- Apply the D and L notation, R and S notation, absolute and relative configurations to organic molecules
C03- Explain the conformational analysis of acyclic and cyclic systems
C04- 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
C05- Discuss the Frank-Condon principle and Jablonski diagram and apply the α -cleavage or γ -hydrogen transfer mechanism to organic molecules
C06- 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****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)

SCYB5203 (REVISED)	STEREOCHEMISTRY AND ASYMMETRIC SYNTHESIS	L	T	P	EL	Credits	Total Marks
		3	1	0	3	4	100

COURSE OBJECTIVES

- To suggest synthetic route for simple organic compounds with stereochemistry
- To understand and appreciate the concept of stereochemistry and reaction mechanism
- To understand the Stereo, Enantio, Regio, Chemo Selective 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 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 4 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 5 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.

Max. 60 Hrs.

COURSE OUTCOME

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

- CO1** - Interconvert the representation and notations for organic molecules.
- CO2** - Sketch the conformational analysis of acyclic and cyclic systems
- CO3** - Solve the organic reactions with respect to stereo, enantio, regio and chemoselectivity
- CO4** - Propose a strategic reaction pathway in synthesizing a chiral product
- CO5** - Predict the products in asymmetric aldol, hydrogenation reactions, hydroformylation, cycloaddition reactions.
- CO6** - Design and predict a suitable asymmetric reaction.

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.

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

80 Marks

SCYA 5303 (OLD)	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 Electrostatic 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:**

- C01-** To understand the theories and applications of electrochemistry.
C02- To learn electrode kinetics and the structure of electrified interfaces.
C03- To know the techniques like polarography, cyclic voltammetry, ion selective electrodes, amperometry.
C04- To study the basic concept of solid state chemistry.
C05- To understand the importance of crystal defects, nonstoichiometry
C06- 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**

SCYB5303 (REVISED)	ELECTROCHEMISTRY AND SOLID STATE CHEMISTRY	L	T	P	EL	Credits	Total Marks
		3	1	0	3	4	100

COURSE OBJECTIVES

- To study the Interaction and Migrations of ions
- To learn the Electrochemical reactions and measurements
- To study about the Corrosion - types and its applications

UNIT 1 ELECTRO IONICS & ELECTRODICS 12 Hrs.

Ion-solvent interactions: Ion-ion interactions - Ionic migration and diffusion - Ionic activity - Debye-Huckel-theory - Debye-Huckel limiting law - Electrolytic conductivity and Debye-Hückel-Onsager theory - Electrochemical interfaces: Electrical double layer - Lippmann equation Helmholtz and Gouy - Chapman - Stern models of the double layer - Modern theories of electrical double layer.

Case study: Chloroacetic acid has a dissociation constant of $K_a = 1.38 \times 10^{-3}$. (a) Calculate the degree of dissociation for 0.0825 M solution of chloroacetic acid using the Debye-Hückel limiting law (b) Calculate the degree of dissociation for 0.022 m in KCl using the Debye-Hückel limiting law.

UNIT 2 ELECTROCHEMICAL REACTIONS & MEASUREMENTS 12 Hrs.

Electrochemical Reactions: Electrochemical cell - Activation in ionic - Ohmic and diffusion overpotentials - Activation polarisation, concentration polarization - Current-potential relationship (derivation of Butler-Volmer and Tafel equations). Electrochemical Measurements: Two Electrode cell and Three Electrode cell - Types of Electrodes: Reference Electrodes, Working Electrodes and Counter Electrodes - Current and diffusion controlled redox reactions - Reversible and Irreversible systems: Quasi-reversible mechanism - Steady-State Polarization Measurements - Transient (Pulse) Measurements - Impedance Measurements.

Case study: Calculate the reversible oxidation of dopamine (DA) in two-electron process. A cyclic voltammetric anodic peak current of $2.2 \mu\text{A}$ is observed for 0.4mM solution of dopamine in phosphate buffer at a glassy carbon disk electrode 2.6 mm^2 area with a scan rate of 25 mVs^{-1} . What will be i_p for $v = 100 \text{ mVs}^{-1}$ and 1.2mM of DA?

UNIT 3 ELECTROCHEMICAL CORROSION STUDIES 12 Hrs.

Electrochemical Corrosion: Different types of Corrosion - Pourbaix diagram - Stern Geary equation - Mixed Potential Theory - Electrochemical Impedance Spectroscopy: Determination of Nyquist plot, Bode Phase angle and impedance plot - Corrosion rate Measurements and Prevention of Corrosion.

Case study: Analyze the corrosion impact for graphene dispersion into coatings prepared under low shear condition with constant stirring at 1000 to 1500 rpm for 10 to 15 minutes.

UNIT 4 ELECTROCHEMICAL SENSORS 12 Hrs.

Electrochemical Sensors: Introduction to Electrochemical Sensors and Biosensors - Electrochemical Sensors in Environmental analysis - Glucose Biosensor - Immune Sensors - ISFETs and CHEMFETS.

Case study: Describe the major problem encountered in the detection of the NADH product of dehydrogenous-based amperometric biosensors and discuss the common approaches to circumvent these problems.

UNIT 5 SOLID STATE CHEMISTRY 12 Hrs.

Solid State Synthesis: Wagner reaction mechanism for solid state synthesis for spinel - Chemical precursor method for perovskite - Intercalation / deintercalation method - Methods of Single Crystal Growth: Hydrothermal method of synthesis - Czochralski method. Solid State Defects: Point Defects - Schottky Defect - Frenkel Defect - Extrinsic and Intrinsic Defects - Applications of Solid Electrolytes in

Batteries, Fuel cells, Oxygen sensor - Vacancies and Interstitials in Non-Stoichiometric – Superconductivity: High Temperature Superconductors: Cuprate Superconductors – Iron Superconductors.

Case study: Calculate the error in millivolt that would occur if the solution containing 5×10^{-5} M of fluoride ion solution (pH 10) is measured with fluoride ISE. ($k_{F,OH}=0.1$).

Max. 60 Hrs.

COURSE OUTCOME

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

- CO1** - Comprehend the theories and applications of electrochemistry.
- CO2** - Interpret the electrode kinetics and the structure of electrified interface.
- CO3** - Examine the basic concept of electrochemical measurements.
- CO4** - Analyze the properties of electrochemical sensors chemical and biological systems.
- CO5** - Evaluate the materials for electrochemical cells.
- CO6** - Evaluate the electrochemical concepts to real time materials.

TEXT / REFERENCE BOOKS

1. Electrochemistry by Carl H. Hamann, Andrew Hamnett and Wolf Vielstich, Wiley VCH, 2007.
2. Modern Electrochemistry 1. Volume 1 and 2, by J. O'M. Bockris and A. K.N. Reddy, Kluwer Academic, 2000.
3. Modern Electrochemistry 1. Volume 1 and 2, by J. O'M. Bockris and A. K.N. Reddy, Kluwer Academic, 2000. L (hrs) Credit 60 4 26
4. Electrochemical Methods, by A. J. Bard and L. R. Faulkner, John Wiley, 2000, 2nd edition.
5. E. Gileadi, Physical Electrochemistry, Fundamental, Techniques and Applications, Wiley-VCH, 2011
6. A. J. Bard and L. R. Faulkner Electrochemical Methods: Fundamentals and Applications, 2nd Edition, Wiley, 2001
7. P. H. Rieger, Electrochemistry, 2nd Edition, Springer 1994
8. J. Newman and K. E. Thomas-Alyea, Electrochemical Systems, 3rd Edition, Wiley Interscience, 2004
9. J. Wang, Analytical Electrochemistry, 3rd Edition, Wiley - VCH, 2006 9. P.T. Kissinger and W.R. Heineman, Laboratory Techniques.

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

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

SCYB 7001	BIOORGANIC CHEMISTRY	L	T	P	EL	Credits	Total Marks
		3	1	0	0	3	100

COURSE OBJECTIVES

- To learn about the isolation and structural elucidation of alkaloids and their significance.
- To emphasize on to the isolation and structural determination of terpenoids and carotenoids.
- To impart an insight into the synthesis and properties of five, six and fused ring heterocyclic compounds

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 -Hammond Postulate-Curtin-Hammett Principle-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- Linear Free energy relationship- Hammett Equation, Taft Equation, sensitivity factors.

UNIT 2 NATURAL PRODUCTS 12 Hrs.

Alkaloids - General occurrence, reactions and degradations. Chemical and Physico-Chemical methods for the elucidation of structures-synthesis and structural elucidation of Atropine & Morphine

Terpenoids - Classification - Nomenclature - Occurrence - Isolation - General methods of structure determination -Isoprene rule. Structure determination, synthesis of the following representative molecules: Menthol, Zingiberene

UNIT 3 SUPRAMOLECULAR CHEMISTRY 12 Hrs.

Concepts of Supramolecular Chemistry: Definition, Nature of supramolecular interactions, Host-guest interaction, Molecular recognition, Types of recognition, Self-assembly. Cation-binding Hosts- Crown ethers, Cryptands, Spherands, Calixarens. Selectivity of cation complexation, Macrocyclic and template effects. Structure & Significance of fascinating molecules like podands, cryptands, spherands, cyclodextrins, cyclophanes clathrates, cavitands.

UNIT 4 PROTEINS 12 Hrs.

Proteins - Introduction to proteins - classification - Nomenclature. Physical properties of proteins- Colour reactions- Isolation and their synthesis of peptides- Structure of proteins- Primary, secondary and tertiary and quaternary structure. Enzymes-mechanism of enzyme action- chymotrypsin; coenzymes.

UNIT 5 PHARMACEUTICAL CHEMISTRY 12 Hrs.

Pharmacy, pharmacology, pharmaco kinetics, pharmaco dynamics, Theory and Mechanism of Drug action -metabolism of drugs- Oxidation, Reduction, hydrolysis, conjugation..Assays of Drugs- Determination of sugar in serum by quantitative methods such as Benedict Test and Fehlings test, Detection of Diabetes, Anaemia, Estimation of Hemoglobin. Structural elucidation of streptomycin and its SAR.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1** - Analyze the mechanism involved in basic organic reactions
- CO2** - Elaborate on structural elucidation and chemical synthesis of alkaloids, terpenoids
- CO3** - Understand the role of Supramolecules and their significance.
- CO4** - Assess the importance of proteins and enzymes.
- CO5** - Examine the action of drugs.
- CO6** - Propose the structural activity of natural products.

TEXT / REFERENCE BOOKS

1. Finar I. L., Organic Chemistry, 6th Edition, Pearson Education Asia, 2004.
2. O.P. Agarwal., Organic Chemistry-Natural Products Vol.I and II, Goel Publishing House, 1980.
3. J. M. Lehn, Supramolecular Chemistry, Concepts and Perspectives, VCH, 1995.
4. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, UK.
5. Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, Vallabhprakashan, Pitampura, NewDelhi.

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)

SCYB7002	SPECTROSCOPY	L	T	P	EL	Credits	Total Marks
		3	1	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.

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 isocyano-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 Hrs.

COURSE OUTCOMES

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

- CO1** - Identification Of $\lambda_{\max}$ Value Of Inorganic and Organic Compounds.
- CO2** - Identify the functional group of molecules using IR Spectral data.
- CO3** - Analyze for NMR chemical shifts and splitting patterns.
- CO4** - Investigate the Mass spectra of a given organic molecule.
- CO5** - Demonstrate ESR hyperfine splitting and Mossbauer spectroscopy.
- CO6** - Examine organic compounds by spectroscopic tools.

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

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)

SCYB7003	PHOTO, HETEROCYCLIC AND PERICYCLIC CHEMISTRY	L	T	P	EL	Credits	Total Marks
		3	1	0	0	3	100

COURSE OBJECTIVES

- To learn the alpha cleavage and gamma hydrogen transfer reactions
- To understand the photochemical organic reactions and rearrangement reactions
- To impart an insight into the synthesis and properties of five, six and fused ring heterocyclic compounds.

UNIT 1 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 2 ORGANIC PHOTOCHEMISTRY II 12 Hrs.

Photoreduction – Paterno-Buchi reactions – di-pi-methane rearrangement – Barton rearrangement – Photo-Fries rearrangement - photochemistry of an 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.

UNIT 3 SYNTHESIS OF HETEROCYCLIC COMPOUNDS I 12 Hrs.

Importance of heterocyclic compounds – classification based on the nature of hetero atom, Synthesis of 5 and 6 membered ring -size of the ring and Π excessive and Π deficient nature of the ring. A general and comparative study of Furan, pyrrole and thiophene Ring transformations. General comparison with benzenoid compounds, pyridine in case of nucleophilic substitution.

UNIT 4 SYNTHESIS OF HETEROCYCLIC COMPOUNDS II 12 Hrs.

Preparations and Reactions of Bicyclic ring systems-Indole, quinoline, Isoquinoline Rings with two heteroatoms- aziridines and oxiranes Imidazole, benzimidazole, purines, pyrimidines- structure and aromaticity. Structure of DNA and RNA.

UNIT 5 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.

Max. 60 Hrs.**COURSE OUTCOME**

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

- CO1** - Apply Frank-codon principle, Jablonski in the α -cleavage or γ -hydrogen transfer mechanism to organic molecules
- CO2** - Illustrate on the mechanism of photochemical reaction
- 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** - Assess Woodward Hoffmann rule, Mobius and Huckel concept and FMO t in pericyclic reaction
CO6 - Evaluate the organic reaction by thermal and photochemical methods.

TEXT / REFERENCE BOOKS

1. E. L. Eliel, Stereochemistry of Carbon Compounds, Tata-McGraw Hill, 14th Reprint Edition, 1990.
2. T.L. Gilchrist., Heterocyclic Chemistry, Longman Scientific and Technology, 2005.
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****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
(Out of 100 marks, maximum of 10% problems may be asked)**70 marks**

SCYA1102 (OLD)	ENGINEERING CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	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

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 H₂ – 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 (CO₂ and H₂O) – 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.

Max.45 Hrs.

COURSE OUTCOMES

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 Nano device fabrication.
CO6- Evaluate the materials for real world applications.

TEXT / REFERENCE BOOKS

1. Introductory Quantum Chemistry, A.K.Chandra, Tata McGraw-Hill, 4th edition, 1994.
2. Physical chemistry, Ira N. Levine, 6th Edition,
3. Quantum chemistry, Ira N. Levine 7th Edition, 2013.
4. Physical Chemistry, David W. Ball and Thomas Baer, Wadsworth Cengage Learning, 2nd Edition, 2014.
5. Concise Physical Chemistry, Donald W. Rogers, John Wiley and Sons, 2011.
6. Principles of Instrumental Analysis, Douglas A. Skoog, Donald M. West, 6th Edition, Cengage, 2014.
7. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpat Rai Publication, 2018.
8. Polymer Science and Technology, Joel. R. Fried, 3rd Edition, Prentice Hall of India Private Ltd (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 with internal choice, each carrying 16 marks

80 Marks

SCYB 1101 (REVISED)	CHEMISTRY (Common to ALL BRANCHES OF ENGINEERING)	L	T	P	C	Total Marks
		3	0	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 know the importance of electrochemistry in batteries.
- To explore the concept of corrosion mechanism and design principles.
- To study the various synthetic approaches in nanochemistry.

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Apply the principles of quantum chemistry for energy quantisation in molecules.

CO2: Analyze the interaction of EMR with matter to study molecular transition.

CO3: Assess the mechanism of energy conversion.

CO4: Comprehend the corrosion mechanism for environmental sustainability.

CO5: Examine the synthetic approaches to promote size dependent properties.

CO6: Evaluate the application of chemical science concept in real world applications.

UNIT-1 ATOMIC AND MOLECULAR STRUCTURE

9 Hrs

Introduction to quantum chemistry – Motion of a quantum mechanical particle in one dimension (time-independent) – Physical meaning of wave function – Schrodinger equation for Hydrogen atom (No derivation. Only 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 H₂ – Band theory of solids: Conductors, semi-conductors– 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 (CO₂ and H₂O) – Determination of Force constant – Electronic transitions in organic molecules – Mathematical derivation of Beer- Lambert's law.

UNIT-3 ELECTROCHEMISTRY

9 Hrs

Electrochemistry: Galvanic cell - Electrochemical cell representation - EMF series and its significance. Batteries: Terminology – Mechanism of Lead-acid accumulator - Mechanism of Nickel-cadmium batteries. Mechanism of Lithium batteries: Li/SOCl₂ cell - Li/I₂ cell - Lithium ion batteries. Mechanism of Fuel Cells: Hydrogen-oxygen fuel cells - Solid oxide fuel cell (SOFC).

UNIT-4 CORROSION SCIENCE

9 Hrs

Introduction: Definition. Types: Dry corrosion: Mechanism - Pilling-Bedworth rule - Wet Corrosion: Mechanism. Types: Galvanic corrosion and differential aeration cell corrosion.

Galvanic series and its significance. Factors influencing corrosion. Corrosion prevention: Material selection and design - Cathodic protection – Sacrificial anodic method and Impressed current method – Inhibitors – Anodic and Cathodic inhibitors.

UNIT 5 CHEMISTRY OF MATERIAL SCIENCES

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 alloy 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.

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. Mars G Fontana, Corrosion Engineering, 3rd Edition, Tata McGraw Hill, 2008.
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. David Linden, Thomas B Reddy, Handbook of Batteries, 4th Edition, McGraw-Hill, 2010.