

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.

CO4: Analyse the errors and standard deviation in experimental results.

CO5: Determine the concentration of unknown samples.

CO6: 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.)

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

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

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

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 Delhi2nded.
3. Soni P.L. and Mohan Katyal, Text Book of Inorganic Chemistry, Sultan Chand and Company Pvt. Ltd, New Delhi, 20thed.
4. Bahl B.S. and Arun Bahl, A text book of Organic Chemistry 21st ed., S. Chand and Company.

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

COURSE ARTICULATION MATRIX:

Course	CO Statement	POs												PSOs		
	At the end the course, the students will	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SCY 1105 – PHYSICAL CHEMISTRY	CO1: Construct phase diagram for one, two and three component system.	2	3	-	2	-	-	-	-	-	-	-	1	-	-	-
	CO2: Deduce the molecular weight from the solubility of solutes in liquids and gases.	2	2	-	-	-	-	-	-	-	-	-	1	-	-	-
	CO3: Assess different separating techniques for chemical system.	-	2	2		-	-	-	-	-	-	-	1	-	-	-
	CO4: Predict the rate of chemical reactions and their mechanism	3	-	-	2	-	-	-	-	-	-	-	1	-	-	-
	CO5: Examine on molecular motion in liquids and their applications	-	2	-	-	-	-	-	-	-	-	-	1	-	-	-
	CO6: Relate the basic chemistry concepts in science and technology	3	1	-	-	-	-	-	-	-	-	-	2	-	-	-
	Average:	2.5	2	2	2	-	-	-	-	-	-	-	1.2	-	-	-