Syllabus

for

B.Sc. I and II semester (Chemistry)

(Revised Curriculum)

2024-25 onwards

Prepared by
BoS (UG & PG) in Chemistry
Tumkur University, Tumakuru

Curriculum

Name of the Degree Program: B.Sc.

Subject/BoS: Chemistry

Discipline Core: Chemistry, Total Credits: 36 (for students not opting deep specialization)

Year of implementation: 2024-25

Course structure for first and second semesters

Semester	L	P	T	Total credits
	4h / week	4h / week	-	
1	4 credits	2 credits	-	6
2	4 credits	2 credits	-	6

Examination structure for first and second semesters

Semester	Paper title	Semester end exam		IA Marks	Total Marks
		Duration	Marks		
1	Chemistry – 1	3h	80	20 (Average of two Tests 10 M + Average of Two Assignments 10M)	100
1	Chemistry Practicals– 1	3h	40	10 (One Test 5 M+ One Assignment 5M)	50
2	Chemistry - 2	3h	80	20 (Average of two Tests 10 M+ Average of Two Assignments 10M)	100
2	Chemistry Practicals– 2	3h	40	10 (One Test 5M+ One Assignment 5M)	50

First Semester

Chemistry-1 60h

Course objectives

1. Understand and Apply Quantum Mechanical Concepts
2. Analyze and Interpret Atomic Structure and Electron Configurations
3. Analyze Periodic Trends and Chemical Behavior
4. Compare and Contrast Elemental Properties
5. Understand Organic Chemistry Fundamentals and Bonding
6. Analyze Reactivity and Reaction Mechanisms
7. Quantify and Interpret Gas and Liquid Properties
8. Apply Theoretical Principles to Solutions

Course outcomes

1. Apply Quantum Mechanical Models to Solve Problems
2. Analyze and Explain Atomic and Electronic Structures
3. Apply Periodic Trends to Predict Chemical Properties
4. Apply Organic Chemistry Principles to Reactions
5. Evaluate and Explain Organic Chemistry Concepts
6. Calculate and Analyze Properties of Gases and Liquids
7. Solve Problems Related to Solutions and Their Properties

Unit-I **15h**

Atomic Structure - 1

Bohr's theory of hydrogen atom: assumptions and limitations, expressions for radius and energy of hydrogen atom and hydrogen atom like ions He^{+}, Li^{2+} (no derivations), explanation of atomic spectra of hydrogen atom (occurrence of different series in the spectrum), numerical problems on the calculation of wave numbers of spectral lines.

Wave Mechanics

Need for a new approach to atomic structure, de Broglie hypothesis (statement and equation), Heisenberg's uncertainty principle (statement and equation) and its significance, numerical problems on de Broglie equation and Heisenberg's uncertainty principle. Concept of orbits and orbitals. Time-independent Schrödinger's wave equation (cartesian coordinate only, no derivation)–one-dimensional and three-dimensional equations, significance of Schrödinger's wave equation.

Wave Functions: Characteristics of well-behaved wave functions (few simple examples should be discussed), significance of ψ and ψ^2 (or $\psi\psi^*$) (probabilistic approach), normalized and orthogonal wave functions, normalization condition. Quantum numbers and their significance. Time-independent

Schrodinger wave equation for the hydrogen atom and its solution (R, θ and φ equations in cartesian and polar coordinates; only expressions, no derivations). Radial and angular wave functions for hydrogen atom, spherical harmonics. Radial and angular distribution curves: Shapes of *s*, *p*, *d* and *f* orbitals, radial distribution functions (probability diagrams) for 1s, 2s, 2p, 3s, 3p and 3d orbitals (only graphical representation), radial and angular nodes, nodal planes.

Rules for filling up of electrons in various orbitals: Hund's rule of maximum multiplicity, Pauli's exclusion principle, Aufbau principle (n+l rule), variation of orbital energy with atomic number, stability of half-filled and completely filled orbitals, concept of exchange energy, anomalous electronic configurations (Cr and Cu). Electronic configuration of elements (up to Z =30).

UNIT II **15 h**

Periodic table and periodicity

Review of the modern periodic table (with respect to the classification of elements based on outer electronic configuration).

Periodicity in *s* and *p*-block elements, trends in the periodic properties. Applications in predicting and explaining chemical behaviour with respect to a) electronic configuration b) effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table, c) Atomic radii–the concept of various radii–ionic radii, covalent radii, van der Waal radii with examples; variation of the atomic radii across the period and down the groups, d) ionization enthalpy, successive ionization enthalpies and factors affecting ionization enthalpy, e) Electron affinity of atoms–definition, illustration, variation of the values along the periodic table and explanation of the trends, f) electronegativity (E.N)–the concept of electronegativity and its difference from electron affinity; Ionic characters of bonds and the E.N. difference, other E.N. scales–the Mulliken, Allred–Rochow scales (problems). Applications of electronegativity.

Diagonal relationship -definition, reason, diagonal relationship between Lithium and Magnesium, beryllium and aluminium.

Comparative study of elements of alkali and alkaline earth metals.Trends in the chemistry of the compounds of groups 13 to 17 (hydrides, carbides, oxides, and halides) are to be discussed (qualitative only).

Unit-III **15h**

Basics of Organic Chemistry

Introduction to organic chemistry, catenation, classification and IUPAC nomenclature of some important

organic compounds. Chemical bonding, formation of covalent bond, hybridization- formation and structure of ethane, ethene and ethyne. Localized and delocalized, conjugation and cross conjugation with suitable example.

Factors affecting reactivity of organic compounds (electronic effects) : Inductive effect – definition, +I and –I effect with suitable examples. Resonance effect–definition, +R and –R effect with suitable examples. Electrometric effect– definition with examples. Hyperconjugation – definition, ethyl carbocation and propene as examples (propene is more stable than ethene).

Bond cleavage–homolysis and heterolysis with examples. **Reactive intermediates:** Carbocations, carbanions, carbon free radicals and carbenes- Generation, structure, stability and reactivity. Types of reagents – electrophiles and nucleophiles with examples.

Types of organic reactions–Substitution (Electrophilic and nucleophilic), addition, elimination, and rearrangement (inter and intramolecular) reactions, explanation with examples.

Chemistry of saturated Aliphatic Hydrocarbons

Alkanes: Introduction, natural sources, preparation – by catalytic hydrogenation of alkenes and alkynes, Wurtz reaction, Kolbe's electrolysis, Grignard reagents, Wurtz-Fittig reaction for alkyl arenes. Free radical substitutions–chlorination of methane and propane with mechanism. Conformational analysis of alkanes: ethane, butane and cyclohexane.

Unit-IV **15h**

Gaseous state **7h**

Introduction. Maxwell-Distribution of molecular velocities-equation only, explanation of important features of the Maxwell's distribution curves of molecular velocities, effect of temperature on distribution of molecular velocities. Types of molecular velocities-most probable velocity, average velocity and root mean square velocity-derivation of expressions from Maxwell-Boltzmann distribution equation, relationships among them, Numerical problems in SI units.

Real gases- a review of van der Waal's equation of state, critical constants of a real gas Tc, Pc and Vc-definition and significance, derivation of expression for critical constants from van der Waal's equation, critical compressibility factor, Numerical problems on the calculation of Tc, Pc, Vc and van der Waal's constants a and b, Andrew's isotherm on carbon dioxide and explanation of the curves (no experimental details). Law of corresponding states-statement, explanation, reduced equation of states. Liquefaction of gases-Joule-Thompson effect-definition, explanation, Joule-Thompson coefficient, Inversion temperature (definition, significance, no derivation), application to the liquification of air and hydrogen (Linde's

process in detail).

Liquid state **4h**

Surface Tension: Definition and explanation, its SI unit, effect of temperature and solute on surface tension, significance of surface tension (mention any two), determination of surface tension using stalagmometer. Surface active agents-definition and examples.

Viscosity: Definition and explanation, coefficient of viscosity, SI unit, Determination of viscosity of a liquid using Ostwald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces (qualitative discussion only).

Solutions-1 **4h**

Completely miscible liquids: Ideal and non-ideal solutions, Thermodynamics of ideal solutions- Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Numerical problems on Raoult's law (vapour pressure calculation).

Recommended Books/References:

1. Concise Inorganic Chemistry: J. D. Lee, Wiley, 4th edition (2021).
2. Fundamentals Concepts of Inorganic Chemistry, Vols. 1 and 2, Asim K. Das, CBS Publishers and Distributors, 2nd edition (2013).
3. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, P. L. Gaus, Wiley. India, 3rd edition (1995).
4. Inorganic Chemistry, Catherine E. Housecroft, A.G. Sharpe, Pearson Prentice Hall, 2nd edition (2005).
5. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Text book of Organic chemistry - Jagdamba Singh, vol. I and II.
9. Advanced Organic Chemistry - Reactions, Mechanism and Structure, Jerry March, John Wiley (2008).
10. Advanced Organic Chemistry, F A Carey and R J Sundberg Plenum, (1990).
11. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman, (2000).
12. Atkin's Physical Chemistry, Peter Atkins, Julio De Paula, Oxford University Press, 8th edition (2006).
13. Elements of Physical Chemistry, Samuel Glasstone, David Lewis, Palgrave Macmillan, 2nd edition (1963).
14. A Text book of Physical Chemistry, A. S. Negi, S. C. Anand, New Age International Publishers (2007).
15. Principles of Physical Chemistry, Puri, Sharma, Pathania, Vishal Publishing Co., 47th edition (2020).
16. A Text Book of Physical Chemistry P. L. Soni, O. P. Dharmarha and, U. N. Dash, Sultan Chand and Sons (2016).
17. Advanced Physical Chemistry, Gurdeep Raj, Krishna Prakashan Media Publishers (2020).

Chemistry practicals-1 4h/week

Course objectives

1. To learn basic laboratory practices and basic practical concepts
2. To understand the principle and to learn the skill of estimation by volumetric titrations
3. To learn basic purification techniques
4. To learn determination of density, viscosity and surface tension of liquids as well as mixtures.

Course outcomes

1. Apply basic laboratory practices and use basic concepts every day in laboratory
2. Quantitative estimation of the given compound by volumetric titrations
3. Apply preliminary purification techniques such as distillation, recrystallization etc.
4. Determination of surface tension and viscosity of liquids and estimation of composition of mixture.

Basic concepts: Demonstration of laboratory practices [safety, glassware/chemicals handling, chemical nature understanding, chemical/glassware waste management, error analysis], calibration of laboratory glassware [pipettes and burettes].

Practical concept of Molarity, Molality, Normality, Weight %. Preparation of standard solutions, normal solutions, and dilution of stock solutions (0.1M) to different concentrations.

Note: Minimum eight experiments to be performed giving equal weightages to Part-A and Part-B.

Part -A

1. Estimation of oxalic acid using potassium permanganate solution.
2. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using an internal indicator.
3. Estimation of Mohr's salt (FAS) by titrating with $KMnO_4$.
4. Estimation of sodium carbonate and sodium hydrogen carbonate (sodium bicarbonate) present in a mixture by double indicator method.

Part -B

1. Purification of organic solids by recrystallization (from water and alcohol) and determination of melting point.
2. Purification of organic liquids by distillation and determination of boiling point.
3. Determination of density and surface tension of a liquid using a stalagmometer (Ethyl acetate, toluene, chlorobenzene or any other non-hazardous liquids).
4. Study of the variation of surface tension of a detergent solution with concentration.
5. Determination of density and viscosity of a liquid using an Ostwald's viscometer (Ethyl acetate, toluene, chlorobenzene or any other non-hazardous liquids).

6. Study of the variation of viscosity of sucrose solution with concentration.
7. Determination of the composition of liquid mixture by viscometry method (toluene and alcohol or any other pair of non-hazardous miscible pair of liquids).

Recommended Books/References:

1. Vogel's text book of Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell, Prentice Hall, 5th edition (1989).
2. Elementary Practical Organic Chemistry-Part-III: Quantitative Organic Analysis, Arthur I, Vogel, Pearson India (2011).
3. Laboratory manual of Organic Chemistry, B. B. Dey and M. V. Sitaraman, Laboratory manual of Organic Chemistry, B. B. Dey, M. V. Sitaraman, T. R. Govindachari, Allied Publishers, New Delhi (1996).
4. Practical Organic Chemistry, F. G. Mann, B.C. Saunders, Pearson Education Limited, 4th edition (2011).
5. Practical Volumetric Analysis, A. C. Peter, McPherson, Royal Society of Chemistry, Cambridge, UK (2015).
6. L. Rakesh Sharma, Practical Inorganic Chemistry (for undergraduate students), Evincepub publishing, 1st edition (2021).
7. Practical physical chemistry by B. Viswanathan and P.S. Raghavan, Viva publishers.
8. Advanced practical physical chemistry by J.B.Yadav, Krishna's Educational publishers.

Second Semester

Chemistry-2 60h

Course objectives

1. To understand bonding principles and energy calculations
2. To learn predicting Molecular Structures
3. To understand the Reactions of Unsaturated and Aromatic Hydrocarbons
4. To comprehend the Chemistry of Halides
5. To learn preparation and reaction of different oxygen containing organic compounds
6. To understand different concepts of ionic equilibria
7. To understand Partial Miscibility and Immiscibility

Course outcomes

1. Competence in Bonding and Energy Concepts
2. Accurately predict molecular shapes and bonding arrangements
3. Competence in Organic synthesis and Organic Reaction Mechanisms of unsaturated and aromatic hydrocarbons, halides and oxygen containing organic compounds.
4. Application of different principles of ionic equilibria to different problems
5. Application of Steam Distillation, determination of miscibility temperature.

Unit-I **15h**

Chemical Bonding and Molecular Structure

Ionic Bonding:

Recapitulation of definition, energy considerations in ionic bonding – factors favouring the formation of an ionic bond, general characteristics of ionic compounds. Lattice energy – definition, factors affecting lattice energy, Born-Lande equation and explanation of the terms involved (derivation not required) Kapustinskii equation. Born-Haber cycle and its application for the calculation of lattice energy of NaCl and MgO , numerical problems on lattice energy.

Solvation energy – definition. Importance of lattice energy and solvation energy in the context of stability and solubility of ionic compounds.

Covalent Bonding: Definitions of covalent and coordinate bonds (dative bonds).

Valence Bond Theory (VBT) - assumptions, σ and π bonds (using H_2, HF, O_2 and N_2 molecules as examples), limitations. Polarization, polarisability and polarizing power of ions, Fajan's rules, ionic character in covalent compounds. Definitions of the bond moment and dipole moment by taking H_2, HCl, CO_2, H_2O and NH_3 as examples.

Shapes of molecules and ions based on VSEPR Theory – calculation of total number of electron pairs,

number of bond pairs, number of lone pairs and predicting the shapes of the molecules and ions by taking $BeCl_2$, BCl_3, NO_3^-, SO_2, NH_3, NH_4^+, PF_5, H_2O, SF_4, ClF_3, SF_6, XeF_4, BrF_5 and I_3^- as examples.

Concept of hybridization with suitable examples of linear, trigonal planar, tetrahedral, trigonal bipyramidal and octahedral arrangements (Eg. $BeCl_2$, BF_3, CCl_4, PCl_5, SF_6).

Concept of resonance and resonating structures in various inorganic compounds; CO, CO_2, CO_3^{2-}, SO_2, SO_4^{2-}, NO_3^-.

Unit-II **15h**

Chemistry of unsaturated Aliphatic Hydrocarbons

Alkenes and alkynes: Formation by elimination reactions: Alcohols, 1,2-dihalides and tetra-halides. Saytzeff and Hofmann eliminations. Addition reactions- Hydrogenation, hydration, epoxidation of alkenes (each with examples) Addition of HBr to alkenes- Addition of HBr to propene (Markonikoff's and anti-Markonikoff's rules with examples). Ozonolysis- mechanism of ozonolysis of propene, Significance.

Aromatic Hydrocarbons

Introduction and characteristics of aromatic hydrocarbons. Concept of resonance, aromaticity,

Huckel rule-explanation with examples. Aromatic character of arenes. (benzene and benzenoids).

Preparation of,

1. Benzene (a) from acetylene (b) by decarboxylation of benzoic acid
2. Naphthalene (a) from phenyl-1-butene (b) from α-tetralone

Reactions with mechanisms (by taking benzene as an example): Electrophilic substitution – nitration, halogenation (chlorination), sulphonation, Friedel-Craft's alkylation and acylation. Polycyclic arenes as carcinogens–definition of carcinogen, name and structure of benzo[a]anthracene and benzo[a]pyrene.

Alkyl and Aryl halides

Alkyl Halides: Preparation – from alkenes (addition of HCl and HBr) and alcohols (using PCl_5 and $SOCl_2$). Nucleophilic substitution reactions–definition with examples (hydrolysis, and nitro formation Williamson's ether synthesis). Mechanisms of S_N^1 & S_N^2 reactions, Stereochemistry and factors effecting S_N^1 and S_N^2 reactions. Elimination reaction with example.

Aryl Halides: Preparation of chloro, bromo and iodo-benzene from phenol, preparation of chlorobenzene by Sandmeyer reaction. Reactions of chlorobenzene – aromatic nucleophilic substitution (replacement of –Cl by –OH group), effect of activating group (Eg. $–NO_2$) on aromatic nucleophilic substitution of chlorobenzene.

Unit-III **15h**

Compounds containing Oxygen-1

Alcohols: Preparation of 1º, 2º and 3º alcohols using Grignard reagents, ester hydrolysis, reduction of aldehydes, ketones, and carboxylic acid. Reactions – with sodium, and HCl (Lucas test), esterification, oxidation (alkaline $KMnO_4$, acidified $K_2Cr_2O_7$ and con. HNO_3). Test for alcohols (Lucas test and Victor Meyer test). Oppeneauer oxidation, oxidation of 1,2-diols using HIO_4, mechanism of Pinacol-Pinacolone rearrangement. Chemistry of methanol poisoning and harmful effects of ethanol on the human body.

Phenols: Preparation – of phenol from cumene hydroperoxide and diazonium salts. Reactions – Electrophilic substitution – nitration, bromination and sulphonation. Reimer-Tiemann Reaction (with mechanism), Schotten – Baumann Reaction. Uses of phenol – preparation and applications of phenolphthalein, reason for the change in colour of phenolphthalein with pH.

Ethers: Nomenclature, isomerism, preparation by Williamson's ether synthesis. Reactions of ethers – cleavage by acids, Claisen rearrangement with mechanism.

Aldehydes and Ketones: Introduction, preparation of aldehydes – Rosenmund reduction, Etard's reaction. Preparation of ketones from nitriles and Grignard reagents. Reactions of formaldehyde, acetaldehyde, benzaldehyde and acetone: Nucleophilic addition – addition of water, HCN, alcohol; Condensation reactions – hydroxylamine, hydrazine, phenylhydrazine and 2,4-DNP; Oxidation with $KMnO_4$, Tollen's reagent and Fehling's solution. Reduction – Wolf Kishner, MPV reaction, mechanism of Clemmenson reaction and Cannizaro's reaction. Knoevenagel and Perkin reaction.

Unit-IV **15h**

Ionic equilibria **11h**

Electrolytes-Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization. ionization constant. Ionic product of water. Ionization of weak acids and weak bases-degree of dissociation, dissociation constant, Ostwald's dilution law (derivation). pH, pOH and pH scale. Common ion effect-definition and applications. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for four types of salts. Buffer solutions- definition, types and preparation, pH of buffer-Henderson's equation (derivation), buffer action, applications. Solubility and solubility product of sparingly soluble salts (AB and AB_2 type salts)– applications of solubility product. (Numerical problems for all concepts).

Solutions-2 **4h**

Partially miscible liquids and immiscible liquids:

Partial miscibility of liquids: Miscibility and Critical solution temperature; Examples for partially miscible liquid pairs with UCST, LCST and both UCST & LCST, effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle and application of steam distillation. Numerical problems on steam distillation.

Recommended Books/References:

1. Inorganic Chemistry (4thedition): J.E Huheey, E.A Keiter and R.L. Keiter (1993); Harper Collins.
2. Introduction to modern inorganic chemistry (4thedition): K.M. Mackay and R.A Mackay (1989): Blackie.
3. Advanced inorganic Chemistry (5thedition): F.A Cotton and G.Wilkinson (1990): Wiley.Concise
4. Inorganic Chemistry (5thedition): J.D. Lee (2000); Blackwell Science.
5. Concepts and Models in Inorganic Chemistry (3rdedition) B.E.Dougglas, D.H. Mc Daniel and Alexander. (2001): Wiley.
6. Chemistry of the Elements: Greenwood and Earnshaw. (1986): Pergamon Press.
7. Inorganic Chemistry (3rd edition): Shriver, Atkins and Langford (1999); Oxford University.
8. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation).
9. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
10. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
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16. Elements of Physical Chemistry, Samuel Glasstone, David Lewis, Palgrave Macmillan, 2nd edition (1963).
17. A Text book of Physical Chemistry, A. S. Negi, S. C. Anand, New Age International Publishers (2007).
18. Principles of Physical Chemistry, Puri, Sharma, Pathania, Vishal Publishing Co., 47th edition (2020).
19. A Text Book of Physical Chemistry P. L. Soni, O. P. Dharmarha and, U. N. Dash, Sultan Chand and Sons (2016).
20. Advanced Physical Chemistry, Gurdeep Raj, Krishna Prakashan Media Publishers (2020).

Chemistry practicals-2 4h/week

Course objectives

1. To learn different organic synthesis
2. To understand elemental analysis of a given organic compound
3. To quantitatively estimate different species/compounds present in the given solution
4. To learn preparation of buffer solutions
5. To learn determination of CST

Course outcomes

1. Competence in synthesizing different organic compounds
2. Practically analyze different elements in a organic compound
3. Learn the skill for different quantitative estimation
4. Mastery in preparation of buffer solutions
5. Ability to determine CST

Note: Minimum eight experiments to be performed giving equal weightage to Part-A and Part-B.

Part-A

1. Synthesis of *p*-nitro acetanilide from acetanilide using nitrating mixture.
2. Preparation of *p*-bromoacetanilide from acetanilide.
3. Preparation, recrystallization of *m*-dinitrobenzene from nitrobenzene
4. Preparation, recrystallization of tri-bromophenol from phenol.
5. Preparation of 2,4-dinitrophenylhydrazone from benzaldehyde
6. Elemental Analysis of given organic compound by Lassaigne's method or using sodium fusion extract

Part-B

1. Estimation of MnO_2 in pyrolusite by titrating with $KMnO_4$.
2. Determination of hardness of water using EDTA.
3. Standardization of potassium permanganate solution and determination of nitrite in a water sample.
4. Determination of chlorine in bleaching powder using iodometric method.
5. Determination of zinc/Magnesium using EDTA.
6. Study of the variation of mutual solubility temperature with composition for the phenol-water system and determination of the critical solubility temperature.
7. Study of effect of impurity (NaCl) on critical solution temperature of phenol-water system and determination of percentage of impurity.
8. Preparation of buffer solutions:

   (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide.

   (iii) Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

Recommended Books/References:

1. Vogel's text book of Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell, Prentice Hall, 5th edition (1989).
2. Elementary Practical Organic Chemistry-Part-III: Quantitative Organic Analysis, Arthur I, Vogel, Pearson India (2011).
3. Laboratory manual of Organic Chemistry, B. B. Dey and M. V. Sitaraman, Laboratory manual of Organic Chemistry, B. B. Dey, M. V. Sitaraman, T. R. Govindachari, Allied Publishers, New Delhi (1996).
4. Practical Organic Chemistry, F. G. Mann, B.C. Saunders, Pearson Education Limited, 4th edition (2011).
5. Practical Volumetric Analysis, A. C. Peter, McPherson, Royal Society of Chemistry, Cambridge, UK (2015).
6. L. Rakesh Sharma, Practical Inorganic Chemistry (for undergraduate students), Evincepub publishing, 1st edition (2021).
7. Practical physical chemistry by B. Viswanathan and P.S. Raghavan, Viva publishers.
8. Advanced practical physical chemistry by J.B.Yadav, Krishna's Educational publishers.

Submitted by BoS (UG & PG) in Chemistry, Tumkur University

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3. Sri Dakshinamoorthy, Member
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7. Dr. B. Nirmala, Member
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External members

1. Prof. Yadhav Bodke
2. Prof. G.K. Nagaraj
3. Dr. Rohith K

Question paper pattern
(I & II Semester)

B.Sc. in Chemistry (Revised curriculum)

Undergraduate Programme

2024-25

BOS (UG & PG) Chemistry
Tumkur University, Tumakuru

CHEMISTRY EXAMINATION PATTERN

FOR

CORE PAPERS (I-II Semester B. Sc)

Theory: 4 Credits : 100 Marks
[Summative assessment (SA)-80 Marks + Internal assessment (IA)-20 Marks]

Practicals: 2 Credits : 50 Marks
[Summative assessment (SA)-40 Marks + Internal assessment (IA)-10 Marks]

CREDITS:	**THEORY**	**PRACTICALS**	**TOTAL**
Lecture (L)+ Practical (P)(4:2)	**Maximum Marks (M)**		
Internal Assessment (IA)	**20** Avg. of two Tests (10) Avg. of two Assignments (10)	**10** 1 Test (5) 1 Assignment (5)	**30**
Summative Assessment (SA)	80	40	**120**
Duration of end semester examination	3 hours	3 hours	
Maximum marks	**100**	**50**	**150**

BLUE PRINT OF QUESTION PAPERS FOR EXAMINATION AND EVALUATION

CORE PAPERS (I-II Semester B. Sc)

Theory

DURATION: 3 HOURS	**THE QUESTION PAPER SHALL CONSIST OF TWO PARTS: PART A AND PART B**	**MAXIMUM MARKS: 80**
Part A	Answer any 10 out of 12 questions [Q1 to Q12] **(three questions from each unit)**	10 ×2 =20
Part B	Answer any 6 out of 8 questions [Q13 to Q20] **(two questions from each unit)**	6 × 10 =60
i) Equal weightage of marks shall be given to all the units in Part A and Part B. ii) In part B, each main question shall have only three sub-divisions (a), (b) and (c) with (4+3+3) marks respectively.		

Practical

Duration: 3 Hours	**Max. Marks: 40**
Performance	**30 marks** Two experiments: One from part-A and one from part-B
Viva	**5 marks**
Record	**5 marks** (minimum 8 experiments to be recorded)