BIDAR UNIVERSITY

Distribution of Courses/ Papers in Undergraduates Programme I to VI Semester B.Sc., CHEMISTRY: SYLLABUS: (SEP) effect from 2024-25

Semester	Course/ Paper code	Title of the Papers	Marks			Teaching			Credits	Examination Duration
			SEM EXAM	IA	Total	L	T	P		
I	DSC- IC	Paper – Chemistry – I	80	20	100	4	-	-	4	3
	DSC- IC	Chemistry Practical - I	40	10	50			2	2	3
II	DSC- 2C	Paper – Chemistry – II	80	20	100	4	-	-	4	3
	DSC- 2C	Chemistry Practical – II	40	10	50			2	2	3
III	DSC- 3C	Paper – Chemistry – III	80	20	100	4	-	-	4	3
	DSC- 3C	Chemistry Practical - III	40	10	50			2	2	3
IV	DSC- 4C	Paper – Chemistry – IV	80	20	100	4	-	-	4	3
	DSC- 4C	Chemistry Practical – IV	40	10	50			2	2	3
	SEC-4C	Paper –SEC-Chemistry-IV	40	10	50	2	2	-	2	2
V	DSC- 5C	Paper – Chemistry –V	80	20	100	4	-	-	4	3
	DSC- 5C	Chemistry Practical – V	40	10	50			2	2	3
	SEC-5C	Paper –SEC-Chemistry-V	40	10	50	2	2	-	2	2
VI	DSC- 6C	Paper – Chemistry – VI	80	20	100	4	-	-	4	3
	DSC- 6C	Chemistry Practical - VI	40	10	50			2	2	3
	SEC-6C	Paper –SEC-Chemistry-VI	40	10	50	2	2	-	2	2

Practical /Batch = 16 students

***In Semester – III and Semester – IV elective papers are offered. There shall be 02 elective papers offered during each semester (Semester – III and Semester – IV) by every major subject offering Department, where a student shall Choose/select/opt 01 paper out of two to study in each semester (Semester – III and Semester – IV). Student has to compulsorily choose one of the Skill Enhanced Course (IV, V or VI Semester) from their respective DSC Papers**

B. Sc. First Semester
DSC – 1C: Chemistry Paper–I

UNIT-I

Atomic Structure **15 Hours**

Review of Bohr's atomic model. Derivation of expressions for radius, energy and ionization energies of hydrogen and hydrogen like species. Numerical Problems. Limitations of classical mechanics. Wave particle duality, de Broglie equation. Uncertainty principle-statement.

Quantum numbers (only qualitative): definition and significance. Calculation of k, *l*, *m* and *s* values for a given values of *n* (1, 2 and 3). Rules for filling electrons in various orbitals: Aufbau principle and its limitations, Pauli's exclusion principle and Hund's rule of maximum multiplicity. Electronic configuration of elements (up to atomic number 30). Stability of half-filled and completely filled orbitals. Concept of exchange energy. Relative energies of atomic orbitals. Anomalous electronic configurations.

Periodic Table and Periodic properties

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

Periodic properties: Atomic and ionic radii, ionization energy, electron affinity and electronegativity-definitions. **Trends in the periodic properties-** across the period and down the group. Applications in predicting and explaining chemical behavior - reactivity and reducing power. Factors affecting the values of ionization energy. Determination of electronegativity by Pauling's method. Diagonal relationship and its influence on the properties on beryllium and aluminium.

Comparative study of elements of alkali and alkaline earth metals. Chalcogens and halogens with respect to electronic configuration, atomic and ionic radii, ionization energy and electronegativity. Halides, oxides and carbonates of alkali and alkaline earth metals. Hydrides of chalcogens and halogens-comparative study of all these with respect to their reactivity.

UNIT-II

Basic concepts in organic chemistry **15 hours**

Nomenclature of organic compounds.

Bond cleavage - Homolytic and heterolytic - Explanation with examples for each type. Types of reagents: Electrophilic and nucleophilic reagents- meaning, examples for each type. Reactive intermediates - generation and relative stabilities of carbocation, carbanion, carbon free radicals and carbenes-explanation for relative stability and reactivity based on inductive, resonance and hyperconjugative effects. Introduction to benzyne – stability based on Huckel's rule of aromaticity and generation of benzyne with mechanism.

Types of reactions: addition, substitution and elimination-explanation examples for each type of reaction.

Aliphatic Hydrocarbons

Alkanes: Sources, Nomenclature of branched chain alkanes, preparation of symmetrical and unsymmetrical alkanes: Corey-House reaction and Wurtz reaction- their merits and demerits. Conformational analysis of ethane and *n*-butane, Sawhorse and Newman projection formulae to be used –Energy profile diagram.

Cycloalkanes: Nomenclature. Methods of preparation from (1) dichloropropane, (2)cyclopentanone, (3) benzene. Explanation for stability based on heat of hydrogenation data. Baeyer's strain theory and its limitations, Sachse -Mohr theory of strainless rings; cyclopropane ring-banana bonds.

Alkenes: Preparation of alkenes by Wittig reaction-stereoselectivity. Addition of HX to unsymmetrical alkene - Markovnikov's rule and anti Markovnikov's addition with mechanisms.
Reactions: Hydroboration-oxidation, reduction, oxymercuration- demercuration, epoxidation-general reactions, with an example of ethane (or propene).
Mechanism of oxidation with $KMnO_4$ and OsO_4. Ozonolysis- mechanism and its importance.

Dienes: Classification- isolated, conjugated, cumulated- one example for each type. Structure of allene and butadiene. 1,2-addition and 1,4 addition reactions.

Diels Alder reaction: 1,3-butadiene with maleic anhydride as an example.

Alkynes: Methods of preparation: dehydrohalogenation of vicinal and germinal dihalides and higher alkynes from terminal alkynes. Reactions- metal ammonia reduction and its significance.

Oxidation with $KMnO_4$, acidic nature of terminal alkynes with example of reaction with ammoniacal solutions of silver nitrate and cuprous chloride.

UNIT-III

Liquids and Solutions **15 Hours**

Properties of liquids: Viscosity–definition, co-efficient of viscosity, mathematical expression, factors affecting viscosity-effect of temperature, size, weight, shape of molecules and intermolecular forces on it. Surface tension-Definition, mathematical expression, effect of temperature and solute on surface tension.

Numerical problems on viscosity and surface tension by drop number method.

Liquid Mixture: Review of Raoult's law of dilute solutions, ideal and non-ideal solutions. Completely miscible liquids - theory of fractional distillation of binary liquids with diagram. T-C curves for all the three types, azeotropic mixtures-examples.

Partially miscible liquids: Critical solution temperature-definitions with any one example for each type - explanations with curves (three types). Effect of addition of salt on CST of phenol-water system. Immiscible liquids, examples. Theory of Steam distillation with derivation for the expression of ratio proportion of liquid mixtures and its applications.

Distribution law: Statement, partition coefficient and condition for validity of distribution of distribution law. Application-solvent extraction (no derivation)

Dilute solutions: Review of colligative properties.
Determination of molecular mass of a solute by (i) Berkeley-Hartley's method (ΔT_b) (ii) Beckmann's method (ΔT_f) and (iii) Landsberger's method. Numerical problems on determination of molar mass. Abnormal molar mass, van't Hoff factor *i* and its significance.

Surface chemistry
Theories of adsorption: Adsorption isotherms-Freundlich adsorption isotherm–equation and limitations. Langmuir adsorption isotherm and BET equation (derivation not included).

Adsorption indicators: definition and examples. Surface film on liquids-different types.

Catalysis: Types and theories with examples (intermediate compound theory and adsorption theory). Heterogeneous catalysis: surface reactions, unimolecular, bimolecular surface reactions. pH dependence of rate constant of catalysed reactions. Auto catalysis with examples.

UNIT-IV **15 Hours**

Language of analytical chemistry: Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method - accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD), Limit of quantification (LOQ), linear dynamic range (working range).

Errors and treatment of analytical data: Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance. External standard calibration - regression equation (least squares method), correlation coefficient (R^2).

Numerical problems

Basic laboratory practices: calibration of glassware (pipette, burette and volumetric flask), Sampling (solids and liquids), weighing, drying, dissolving, Acid treatment, Rules of work in analytical laboratory, General rule for performing quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.

Chemistry Paper-I: Blue Print

Sl. No.	Name of the chapter	No. of hours	Marks
1	Atomic structure	06	8
2	Periodic table and periodic properties	09	12
3	Basic concepts of organic chemistry	05	6
4	Aliphatic hydrocarbons	10	14
5	Liquids and solutions	10	14
6	Surface chemistry	05	6
7	Language of analytical chemistry	05	6
8	Errors and treatment of analytical data:	07	10
9	Basic laboratory practices	03	4
	Grand total	**60**	80

DSC – 1C : Chemistry Practical - I

1. Calibration of glass wares: (i) Pipettte, (ii) Burette, (iii) Volumetric flask.
2. Estimation of potassium permanganate using standard sodium oxalate solution.
3. Estimation of ferrous ammonium sulphate using standard potassium dichromate sodium oxalate solution with diphenyl amine as an internal indicator.
4. Estimation of sodium thiosulphate using standard potassium dichromate solution.
5. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
6. Calibration of thermometer.

   80-82 ^{0}C (Naphthalene), 132.5-133 ^{0}C (Urea). 100^{0}C (distilled water)

   Determination of melting point.

   naphthalene 80-82 ^{0}C. 113.5-114^{0}C (Acetanilide), Benzoic acid 121.5-122 ^{0}C, Urea 132.5-133^{0}C

   Succinic acid 184.5-185 ^{0}C, Cinnamic acid113.5-114 ^{0}C, m-Dinitrobenzene 90 ^{0}C, P-Dichlorobenzene 52 ^{0}C,

   Aspirin 135^{0}C acid 132.5-133 ^{0}C. Salicylic acid 157.5-158 ^{0}C Acetanilide

   Determination of boiling Points :

   Ethanol 78 ^{0}C, Cyclohexane 81.4 ^{0}C , Toluene 110.6 ^{0}C, Benzene 80 ^{0}C,

   Mixed melting point determination : urea – cinnamic acid mixture in composition (1:4, 1:1,4:1)10
7. Determination of distribution coefficient of benzoic acid between water and toluene.
8. Determination of distribution coefficient of acetic acid between water and butanol.
9. Determination of density using specific gravity bottle and viscosity of a liquid using Ostwald's viscometer.
10. Determination of density using specific gravity bottle and surface tension of a liquid using Stalagmometer.

References:

1. Concise Inorganic Chemistry: J D Lee, 4th Edn, Wiley, (2021)
2. Fundamentals Concepts of Inorganic Chemistry, Vol 1 and 2, 2nd Edition, Asim K Das, CBS Publishers and Distributors, (2013)
3. Basic Inorganic Chemistry, F A Cotton, G Wilkinson and P. L. Gaus, 3rd Edition. Wiley. India
4. Inorganic Chemistry, 2nd Edn. Catherine E. Housecroft and A.G. Sharpe, Pearson Prentice Hall (2005)
5. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
6. Organic Chemistry by S. M. Mukherji, S. P. Singh and R. K. Kapoor. (Narosa Publishers)
7. Organic Chemistry, B. S. Bahl and Arun Bahl, S.Chand and sons, New Delhi
8. Organic Chemistry, Vol-I, II and III, Jagadamba Singh and L.D.S. Yadhav, Pragati Prakashan.
9. Essential of Physical Chemistry, Bahl and Tuli
10. Principles of Physical Chemistry, Puri, Sharma and Pathania,
11. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D.Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, Pearson Education Pvt.Ltd.(2007).
12. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th edition, Saunders College Publishing, New York (2005).
13. Analytical Chemistry, G.D. Christian, 6th edition, Wiley-India (2007).

THEORY EXAMIANTION QUESTION PAPER PATTERN FOR MAJOR SUBJECTS

(Semester I – VI)

B.Sc. Semester- I Degree Examinations: 2024-25

(Semester Scheme: New Syllabus: 2024-25)

SUBJECT: SCIENCE COURSE

Paper _____ : _____

Paper Code: _____

Time : 3 Hours **Max. Marks : 80**

Instructions to candidates:

1) **All Sections are compulsory**
2) **Draw neat and labeled diagrams wherever necessary .**

SECTION – A

Minimum TWO question from each unit

1. **Answer all the following questions :** **(2 × 10 =20)**
   a)
   b)
   c)
   d)
   e)
   f)
   g)
   h)
   i)
   j)

SECTION – B
Minimum Two questions from each unit

Answer any SIX of the Following: **(5 × 6 = 30)**

2.

3.

4.

5.

6.

7.

8.

Answer Any Three of the Following : (10 x3 = 30)

9. (a + b)/(a+b+c) From Unit-I

5+5/(6+4)/(2+4+4)

10. (a + b)/(a+b+c) From Unit-II

5+5/(6+4)/(2+4+4)

11. (a + b)/(a+b+c) From Unit-III

5+5/(6+4)/(2+4+4)

12. (a + b)/(a+b+c) From Unit-IV

5+5/(6+4)/(2+4+4)

B. Sc. Second Semester
DSC – 2C: Chemistry Paper–II

UNIT - I

Chemical bonding 15 hours

Ionic bond: Lattice energy: definition and significance. Born-Haber cycle for NaCl and MgO. Born-Lande equation (derivation not required, problems on Born-Lande expression to be worked out). Calculation of lattice energies of NaCl and MgO, effect of lattice energy on solubility of ionic compounds.

Covalent bond: Valence bond approach- postulates of valence bond theory. Hybridization-definition and directional characteristics of sp, sp^2, sp^3, sp^2d, sp^3d^2. Formation and Shapes of $BeCl_2$, BF_3, $SiCl_4$, PCl_5 and SF_6.

VSEPR theory: statement. Examples with reference to shapes of CH_4, NH_3, NH_4^+, H_2O, BrF_3 and ICl^-.

Molecular orbital theory: $H_2, He_2^+, Be_2, N_2, O_2, O_2^-, O_2^{2-}, O_2^+$, CO, NO and NO^+. (bond order, stability and magnetic properties to be discussed). Polarization concept: Fajan's rule-statement, explanation with examples, bond length, bond angle and bond energy-definitions. Polar and non-polar molecules- examples. Dipole moment-definition, unit, examples with zero and definite dipole moment values.

Weak interactions: (i)Hydrogen bond : Intra-molecular and Inter-molecular types, examples. Anomalous properties of HF, H_2O, NH_3 and alcohols, carboxylic acids, nitrophenols and biomolecules (ii) van-der Waal's forces: Noble gases and molecular crystals (dry ice, iodine and solid SO_2).

Metallic bond: Band theory, electrical properties of metals, semiconductors and insulators

UNIT-II

Aromatic hydrocarbons 15 hours

Nomenclature, structure of benzene- using molecular orbital theory. Criteria for aromaticity- Huckel's rule. (examples: cyclopentadienyl anion, cycloheptatrienyl cation, benzene, naphthalene, anthracene and phenanthrene). Anti-aromaticity: definition. General mechanism of aromatic electrophilic substitution. Mechanism of nitration of benzene including evidence for the formation of nitronium ion, energy profile diagram and isotopic effect. Orienting influence of substituents in toluene, chlorobenzene, nitrobenzene and phenol towards electrophilic substitution reactions.

Aromatic nucleophilic substitution: Ipso substitution- *Ex*: conversion of 2,4-dinitrochlorobenzne to 2,4-dinitrophenyl hydrazine. Birch reduction-statement with an example.

Oxidation of naphthalene to phthalic acid, phthalic anhydride and1,4-napthaquinone Anthracene to anthrax quinone and phenanthrene to phenanthraquinone.

Diels-Alder reaction-statement with an example of the reaction between anthracene with 1,2-dichloroethene.

Alkenyl benzenes: Styrene, *cis*- and *trans*-stilbenes- structures and their preparations. Biphenyl: Preparation by Ullmann reaction.

Organic halogen compounds

Alkyl halides: Nomenclature. Nucleophilic substitution reactions - S_N1 and S_N2 mechanisms with energy profile diagrams. Effect of (i) nature of alkyl groups (ii) nature of leaving groups (iii) nucleophiles and (iv) solvents on S_N1 and S_N2 mechanisms. Elimination reactions- E1 and E2 mechanisms; Hofmann and Saytzeff eliminations-explanation with mechanism.

Aryl halides: Preparation by halogenation. Relative reactivity of alkyl, allyl, vinyl, aryl and aralkyl halides towards nucleophilic substitution.

UNIT -III

Quantum Mechanics 15 hours

Limitations of classical mechanics. Sinusoidal wave (explain sinusoidal wave) equation (classical wave mechanics); Derivation of time dependent Schrodinger wave equation. Postulates of quantum mechanics.

Concept of operators. Significance of: (i) Laplacian operator, (ii) Hamiltonian operator (iii) Eigen values and Eigen functions. Significance of ψ and ψ^2. Application of Schrodinger equation to the (i) particle in one dimensional box (derivation required).

Radial probability distribution and angular probability distribution curves. Orbitals -definition and difference between an orbit with orbital. Nodes or nodal planes. Shapes of *s*, *p* and *d* orbitals.

Photochemistry

Laws of photochemistry. Grotthus-Draper law, Stark-Einstein law – Statements, differences between photophysical and photochemical processes-any four differences with examples.

Comparison of photochemical and thermal reactions with an example each. Quantum yield- definition, Magnitude of Quantum yield of photochemical combination of (i) H_2 and Cl_2 (ii) H_2 and Br_2 (iii) dissociation of HI (iv) dimerisation of anthracene: reason for low, high and medium quantum yields.

Photosensitization-definition with example, photostationary equilibrium – definition and example.

Singlet and triplet states – definitions. Fluorescence, phosphorescence, luminescence, bioluminescence and chemical sensors – definitions of all these with suitable examples.

Beer-Lambert's law-statement and its application in colorimetric estimations. Numerical problems on absorption coefficient and molar extinction coefficient.

UNIT – IV 15 Hours

Titrimetric analysis: Basic principle of titrimetric analysis. Classification, Preparation and dilution of reagents/solutions. Normality, Molarity and Mole fraction. Use of $N_1V_1 = N_2V_2$ formula, Preparation of ppm level solutions from source materials (salts), conversion factors.

Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity, acidity.

Complexometric titrimetry: Indicators for EDTA titrations - theory of metal ion indicators, titration methods employing EDTA - direct, back, displacement and indirect determinations, Application- determination of hardness of water.

Redox titrimetry: Balancing redox equations, calculation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using Nernst equation. Applications.

Precipitation titrimetry: Titration curves, titrants and standards, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.

Gravimetric Analysis: Requisites of precipitation, mechanism of precipitation, Factors influencing precipitation, Co-precipitation, post-precipitation, Advantages of organic reagents over inorganic reagents, reagents used in gravimetry 8-hydroxy quinoline (oxine) and dimethyl glyoxime (DMG).

Numerical problems on all the above aspects.

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Chemistry Paper–II: Blue Print

Sl. No.	Name of the chapter	No. of hours	Marks
1	Chemical bonding	15	20
2	Aromatic hydrocarbons	10	14
3	Organic halogen compounds	05	06
4	Quantum Mechanics	09	12
5	Photochemistry	06	08
6	Titrimetric analysis:	10	14
7	Gravimetric Analysis:	05	06
Total		**60**	80

DSC – 2C : Chemistry Practical - II

60 Hours

1. Estimation of zinc in the solution using standard EDTA solution.
2. Standardisation of EDTA solution and the estimation of total hardness of a sample of water.
3. Determination of percentage of iron in haematite using standard potassium dichromate solution with diphenyl amine as an internal indicator.
4. Estimation of carbonate and bicarbonate in a given mixture.
5. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
6. Criteria of Purity: Determination of melting and boiling points.
7. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
   (a) Benzoylation of amines/phenols
8. Determination of critical solution temperature of phenol-water system.
9. Determination of percentage of sodium chloride solution by finding out the CST of phenol-water system.
10. Determination of critical solution temperature of phenol-water system.
11. Determination of percentage of sodium chloride solution by finding out the CST of phenol-water system

References :

1. Concise Inorganic Chemistry: J D Lee, 4th Edn, Wiley, (2021)
2. Fundamentals Concepts of Inorganic Chemistry, Vol 1 and 2, 2nd Edition, Asim K Das, CBS Publishers and Distributors, (2013)
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6. Text Book of Organic Chemistry by K.S. Tiwari and N.K. Vishnoi
7. Organic Chemistry by S. M. Mukherji, S. P. Singh and R. K. Kapoor. (Narosa Publishers)
8. Organic Chemistry, B. S. Bahl and Arun Bahl, S. Chand and sons, New Delhi
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14. Analytical Chemistry, G.D. Christian, 6th edition, Wiley-India (2007).

B. Sc. Third Semester
DSC – 3C: Chemistry Paper–III

UNIT-I 12 Hours

p-Block elements: 07Hours

Comparative Study of Properties of p-block elements with respect to electronic configuration, atomic radius, ionization energy, Electron affinity and Electro- negativity, Compounds of Boron: Preparation, properties, structure and uses of Borazole, Diborane and Boran trifluoride

Carbon Family: Structure and properties of graphite and diamond. Preparation, properties and uses of fluorocarbons and Teflon.

Halogens: Interhalogens-Preparation, properties. Structure and uses of interhalogens of the type AB, AB_3, $AB_5$and AB_7.

d-Block Elements: **05 Hours**

Introduction, comparative study of properties of transition elements of 3d and 4d - series with respect to electronic configuration, oxidation states, atomic volume and densities, atomic and ionic radius, melting point and boiling points, ionization energy, colour characteristic properties, magnetic properties, catalytic activity, interstitial compound formation and complex forming ability.

UNIT-II 12 Hours

Alcohols and Phenols 06 Hours

Alcohols: Preparation of 1°,2°, and 3°alcohols using Grignard reagent, ester hydrolysis, reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions with sodium, HX (Lucas test), esterification, oxidation (with PCC, alkaline $KMnO_4$, acidic dichromate, conc. HNO_3), Pinacol-Pinacolone rearrangement.

Phenols: Preparation of phenol – Cumene hydroxide method, from diazonium salts. Reactions of phenol - Electrophilic substitution (Nitration, halogenation and sulphonation), Reimer – Tiemann Reaction, Gattermann-Koch reaction.

Stereochemistry 06 Hours

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (up to two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). threo- and erythro- ; D and L; *cis* - *trans* nomenclature; CIP Rules: R/ S (for up to 2 chiral carbon atoms) and E / Z Nomenclature (for up to two C=C systems).

UNIT-III 12 Hours

Thermodynamics-I: **06 Hours**

Revision of basic terms, First law of thermodynamics, statement, definition of internal energy and enthalpy, mathematical statement for first law. Calculation of w, q, dU, and dH for the expansion of ideal gas under isothermal and adiabatic conditions for reversible process. Molar heat capacities of gases at constant volume and at constant pressure and relation between them. Zeroth law of thermodynamics. Numerical problems.

Gaseous state: **06 Hours**

Critical phenomenon. PV-isotherm of real gases, continuity of states. The isotherm of carbon dioxide, relationship between critical constants and van der Waal's constants. The law of corresponding states and reduced equation of state. Molecular velocities: Root mean square velocity, average velocity and most probable velocity problems.

UNIT-IV

Chromatography: **12 Hours**

Definition, Terms and parameters used in chromatography, classification of chromatographic methods. Factors affecting band broadening, van-Deemter equation, rate theory, plate theory. Fundamentals of Column Chromatography-Principles, selection of stationary & mobile phase, General account of column chromatographic separation. Column Efficiency.

Paper Chromatography: Principles, Types, Theory R_f values. Methods and applications.

Thin layer Chromatography (TLC): Principles, Mechanism, Methodology Criteria for selection of stationary & mobile phases, Identification and detection, spray reagents, Applications.

Chemistry Paper-I: Blue Print

Sl. No.	Name of the chapter	No.of hours	Marks
1	**p-block elements**	07	12
2	**d-block Elements**	05	08
3	**Alcohols and Phenols**	06	10
4	**Stereochemistry**	06	10
5	**Thermodynamics-I**	06	10
6	**Gaseous state**:	06	10
7	**Chromatography:**	12	20
	Grand total	**48**	80

DSC – 3C: Chemistry Practical - III 60 Hours

Inorganic Chemistry:
Inorganicsemi-microqualitativeanalysiscontainingtwoanionsandtwocations
Acid radicals: - CO^{-3},Cl^{-}, Br^{-}, I^{-}, NO^{-3}, and SO^{-4}

Basic radicals -Cu^{+2},Bi^{+3},Cd^{+2},Co^{+2},Al^{+3},Fe^{+2},Mn^{+2},Zn^{+2},Ca^{+2},Sr^{+2},Ba^{+2},Mg^{+2},Na^{+},$^{+}$and NH^{+4}.

Organic chemistry:
Estimation of Phenol, and Estimation Aniline.
Crystallization: Concept of induction of crystallization, Phthalic acid from hot water (using fluted filter paper and stem less funnel), Acetanilide from boiling water, Naphthalene from ethanol, Benzoic acid from water,
Decolourisation and crystallization using charcoal, Decolourisation of brown sugar (sucrose) with animal charcoal using gravity filtration, Crystallization and decolourisation of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo red using 1g decolorizing carbon) from ethanol.

Physical chemistry:
1. To prepare arsenious sulphide solution and compare the precipitating power of mono, bi and trivalent anions.
2. Determination of transition temperature of the given substance by thermometric /a dialometric method (e.g.$MnCl_2.4H_2O$ or $SrBr_2.2H_2O$)
3. To construct the Phase diagram of two component (e.g., diphenylamine benzophenone) system by cooling curve method.

B. Sc. Third Semester

Elective-1
Chemistry in Daily Life 32 Hours

UNIT-I 08 Hours

Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk.

Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages.

UNIT-II 08 Hours

Paints & Pigments: White pigments (white lead, ZnO, lithopone, TiO_2). Blue, red, yellow and green pigments. Paints and distempers: Requirement of a good paint. Emulsion, latex; luminescent paints.

Dyes: Colour and constitution (electronic concept). Classification of dyes. Methods of applying dyes to the fabrics. A general study of azo dyes, Mordant brown, Congo red and methyl orange.

UNIT-III 08 Hours

Air Pollution: Air pollutants, prevention and control, Greenhouse gases and acid raid. Ozone hole and CFC's. Photochemical smog and PAN. Catalytic converters for mobile sources.

Water Quality: Safe drinking water. Public health significance and measurement of water quality parameters- (Colour, turbidity, total solids, acidity, alkalinity, hardness, fluoride, BOD and COD). Water purification for drinking purposes.

UNIT-IV 08 Hours

Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils.

Soaps & Detergents: Types, Structures, preparation and action of soaps and detergents. Comparison between soaps and detergents.

Chemical energy system: principles and applications of primary & secondary batteries and fuel cell.

References

1. B. K. Sharma: introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry by Ashutosh Kar.
3. Drugs and Pharmaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York.
4. Analysis of Foods – H.E. Cox: 13. Chemical Analysis of Foods – H.E. Cox and Pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998)
6. Physical Chemistry – P l Atkins and J. de Paula – 7th Ed. 2002, Oxford University Press.
7. Handbook on Fertilizer Technology by Swaminathan and Goswamy, 6th ed. 2001, FAI.
8. Organic Chemistry by I. L. Finar, Vol. 1 & 2. 9. Polymer Science and Technology, J. R. Fired

Elective-2

Industrial Chemicals and Environment 32Hours

UNIT-I **8 Hours**

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, hydrogen, acetylene, chlorine.

Inorganic Chemicals*:* Manufacture, application and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, bleaching powder.

UNIT-II **8 Hours**

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone. Major sources of air pollution. Pollution by SO_2, CO_2, CO, NO_x, and H_2S and control procedures.

Effects of air pollution on living organisms and vegetation. Greenhouse effect and global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and halogens.

UNIT-III **8 Hours**

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, fertilizer. Sludge disposal.

UNIT-IV **8 Hours**

Energy and Environment

Sources of energy: Coal, petrol and natural gas. Nuclear fusion/fission, solar energy, hydrogen, geothermal, tidal and hydel.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis: Introduction to biocatalysis: Importance in green chemistry and chemical industry.

References:

1. De, A.K. *Environmental Chemistry*: New Age International Pvt. Ltd, New Delhi, 2010.
2. Stocchi E., *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).
4. Felder R.M. and Rousseau R.W., *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
5. Dara S. S., *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
6. Miller G.T., Environmental Science,11th edition. Brooks /Cole (2006).
7. Mishra, Environmental Studies, Selective and Scientific Books, New Delhi (2005).

B.Sc. Fourth Semester
DSC – 4C: Chemistry Paper–IV

UNIT – I **12 Hours**

f-Block Elements: 06 Hours

Lanthanides-Introduction, electronic configuration, oxidation states, atomic and ionic radii, colour characteristic properties, magnetic properties and complex forming ability of lanthanides. Lanthanide contraction-causes for it and its consequences. Separation of lanthanides by ion exchange method.

Actinides-Introduction, electronic configuration, oxidation states, atomic and ionic radii, colour characteristic properties, magnetic properties and complex forming ability of actinides. Actinide contraction. Similarities and differences between lanthanides and actinides.

Co-ordination Chemistry: 06 Hours

Introduction, definition of the terms, ligands, donors, acceptors, coordination sphere, coordination number. Types of ligands, nomenclature of coordination compounds, Werner's theory of coordination compounds, Sidgwick theory and EAN rule, stereoisomerism of complexes of coordination number 4 and 6.

VBT- Postulates and limitation of valence bond theory, structure and bonding of $[Fe(CN)_6]^{3-}$, $[Fe(CN)_6]^{4-}$, $[Fe(H2O)_6]^{2+}$,$[Cu(NH3)_4]^{2+}$ and $[Ni(CO)_4]$,explanation of outer and inner orbital complexes with examples.

CFT-Postulates, splitting of d-orbital in square planar and octahedral complexes, low Spin and high spin complexes, CFSE and elementary treatment.

UNIT-II **12 Hours**

Aldehydes and ketones (aliphatic and aromatic): **04 Hours**

(Formaldehyde, acetaldehyde, acetone and benzaldehyde)

Preparation*:* from acid chlorides and from nitriles.

Reactions*:* Reaction with HCN, ROH, $NaHSO_3$, NH_2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemmensen reduction.

Amines **04Hours**

Amines (Aliphatic and Aromatic): (Up to 5 carbons)

Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Reactions*:* Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Organic Reactions **04 Hours**

Formation, stability and reactions of i) Carbocations: dienone-phenol. ii) Carbanions: Perkins reaction (mechanism), Aldol condensation, Claisen- Schmidt condensation

UNIT –III 12 Hours

Thermodynamics-II: 06 Hours

Limitation of First law (need of second law). Spontaneous process with examples. Different statements of second law of thermodynamics. Carnot's cycle, efficiency of the heat engine, Carnot's theorem, concept to entropy, entropy as a state function, physical significance of entropy, entropy changes of an ideal gas with changes in P, V and T, calculation of entropy changes in reversible isothermal and irreversible adiabatic process. Problems based on efficiency equation.
Gibb's and Helmholtz free energy functions, Derivation of Gibb's Helmholtz equation. Numerical problems.

Chemical kinetics: 06 Hours

Revision of the concepts, the rate, order and molecularity of reaction and Half-life period. Second order reactions with examples. Derivation of specific rate constant of a second order reaction when a=b. Methods of determination of order of a reaction-differential, half-life and graphical method. Theory of reaction rates-qualitative treatment of collision theory of bimolecular reactions. Theory of unimolecular reactions (Lindmann's hypothesis and steady state principle). An elementary account of transition state theory, activated complex its relation with thermodynamic functions (ΔG^*, $\Delta H^*$and ΔS^*), Numerical problems of second order reactions.

UNIT – IV 12 Hours

Environmental Chemistry: 08 Hours

Chemistry of Environment & Pollution Introduction to segments of Environment (Atmosphere, Hydrosphere, Lithosphere) Definition of pollutant, pollution. Air Pollution: Composition of Air, Acid rain, Greenhouse effect and Global warming, ozone layer depletion.

Water Pollution: Water cycle, Hardness of water, Factors deteriorating the water quality, Eutrophication, Fluoride in drinking water Soil Pollution: Chemical composition of Soil, Soil pollutants, Effects of soil pollution, Control of soil pollution.

Green Chemistry: 04Hours

Introduction, definition of green chemistry, need of green chemistry in our day-to-day life cycle, basic principle of green chemistry, green synthesis of adipic acid, urethane and ibuprofen.

Chemistry Paper–IV: Blue Print

Sl. No.	Name of the chapter	No. of hours	Marks
1	**f-Block Elements**	06	10
2	**Coordination Chemistry**	06	10
3	**Aldehydes and ketones (aliphatic and aromatic):**	04	07
4	**Amines**	04	06
5	**Organic Reactions**	04	07
6	**Thermodynamics-II**	06	10
7	**Chemical kinetics:**	06	10
8	**Environmental Chemistry**	08	13
9	**Green Chemistry**:	04	07
Total		**48**	**80**

DSC – 4C: Chemistry Practical - IV 60 Hours

Organic Chemistry:

Organic qualitative analysis of single compound. Identification of an organic compound through nature of compound, physical constant, elemental analysis, functional group analysis and preparation of suitable derivatives.

- **Carboxylic acids:** Benzoic acid, Cinnamic acid, Salicylic acid and Phthalic acid.
- **Phenols**: Phenol, Cresols,1-Naphthol and 2-Naphthol
- **Aldehydes**: Benzaldehyde.
- **Ketones:** Ethylmethylketone, Acetophenone and Acetone
- **Esters:** Ethyl acetate
- **Hydrocarbon:** Naphthalene and Diphenyl Amine: Aniline and Toluidine.
- **Nitro compounds**: Nitrobenzene and m-Dinitrobenzene
- **Anilides:** Acetanilide
- **Halogen compounds:** Chlorobenzene and Bromobenzene

Inorganic Chemistry:

- Calibration of fractional weights, pipettes and burettes.
- Preparation of standard solutions, dilution-0.2 M to 0.001M solutions

Physical Chemistry:

- Determine the specific rate constant of hydrolysis of methyl acetate by HCl at room temperature.
- Determine the heat of neutralization of strong acid and strong base
- Thermo-chemistry: To determine the solubility of benzoic acid at different temperatures and
- to determine ΔH of the dissolution process.
- To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

B. Sc. Fourth Semester

Elective-3
Molecules of Life 32 Hours

UNIT-I

Carbohydrates **08 Hrs**

Classification of carbohydrates, reducing and non-reducing sugars, General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof).Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

UNIT-II

Amino Acids, Peptides and Proteins **08Hrs**

Classification ofAmino Acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structu re of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (byDNFB and Edman method) and C–terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme).

UNIT-III

Enzymes and correlation with drug action **08Hrs**

Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors andtheir role in biological reactions, Specificity of enzyme action(Including stereospecificity),Enzyme inhibitors and their importance, phenomenon of inhibition(Competitive and Noncompetitive inhibition including allosteric inhibition).

UNIT-IV

Lipids **08 Hrs**

Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

Reference Books:

1. James E. Huheey, Ellen Keiter & Richard Keiter: *Inorganic Chemistry: Principles of Structure and Reactivity,* Pearson Publication.
2. G.L. Miessler & Donald A. Tarr: *Inorganic Chemistry,* Pearson Publication.
3. J.D. Lee: *A New Concise Inorganic Chemistry,* E.L.B.S.
4. F.A. Cotton & G. Wilkinson: *Basic Inorganic Chemistry*, John Wiley & Sons.
5. I.L. Finar: *Organic Chemistry* (Vol. I & II), E.L.B.S.52
6. John R. Dyer: *Applications of Absorption Spectroscopy of Organic Compounds,* Prentice Hall.
7. R.M. Silverstein, G.C. Bassler & T.C. Morrill*: Spectroscopic Identification of Compounds*, John Wiley & Sons.
8. R.T. Morrison & R.N. Boyd: *Organic Chemistry,* Prentice Hall.
9. Peter Sykes: *A Guide Book to Mechanism* in *Organic Chemistry,* Orient Longman.
10. Arun Bahl and B. S. Bahl: *Advanced Organic Chemistry,* S. Chand.

Elective-4

Analytical Methods in Chemistry 32 Hours

Unit-I 8 Hours

UV-Visible and IR Spectrometry

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

UV-Visible Spectrometry*:* Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument;

Infrared Spectrometry*:* Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques. Effect and importance of isotope substitution.

Unit-II 8 Hours

Qualitative and quantitative aspects of analysis

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution of indeterminate errors, statistical test of data; F, Q and t test.

Flame Atomic Absorption Spectrometry

Basic principles of instrumentation: Choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction.

Unit-III 8 Hours

Thermal and electro-analytical methods of analysis

Theory of thermo-gravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Classification of electro-analytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points.

Unit -IV 8 Hours

Separation techniques

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions.

Chromatography: Classification, principle and efficiency of the technique. Qualitative and quantitative aspects of thin layer chromatography (TLC).

Mechanism of separation: Adsorption, partition & ion exchange chromatography.

References:

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.
2. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning,6th Indian Reprint (2017).
3. Christian, Gary D; Analytical Chemistry,6thEd., John Wiley& Sons, NewYork,2004.
4. Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman,2001.
5. Willard, Hobert H. etal. : Instrumental Methods of Analysis,7thEd.,Wardsworth Publishing Company, Belmont, California, USA, 1988.
6. Mikes, O.& Chalmes, R. A .Laboratory Hand Book of Chromatographic &Allied Methods, Elles Harwood Ltd. London.
7. Pavia, Lapmann, Kriz and Vyvyan, Introduction to Spectroscopy, Cengage Learning, 3rd Indian Reprint (2017).
8. Dash UN, Analytical Chemistry

B. Sc. Fourth Semester

SEC – 4C: Chemistry Paper–IV

BASICS OF ANALYTICAL AND PHARMACEUTICAL CHEMISTRY(Credits:2) 30 Hours

Unit I: 15 Hours

Analysis of Soil and Water: Composition of soils, concept of pH and pH measurements, definitions of pure water, sources responsible for contaminating water, sampling methods.

a. Determination of pH of the soil samples

b. Determination of pH of water samples

c. Estimation of available calcium and magnesium in soil samples

d. Determination of alkanility in water samples

e. Determination of Dissolved Oxygen (DO) in water samples

Unit II: 15 Hours

Fermentation: Aerobic and anaerobic fermentation.

Production of

1. Ethyl alcohol and citric acid
2. Antibiotics: Penicillin, Cephalosporin, Chloromycetin and Streptomycin
3. Lysine, Glutamic acid, Vitamin B_2, Vitamin B_{12} and Vitamin C.

REFERENCES:

- G.L. Patric: Introduction to medicinal chemistry, Oxford University Press, UK
- Hakishan, V.K.Kapoor: Medicinal and pharmaceutical chemistry, Vallabh Prakashan, Pitampur, New Delhi.
- William O. Foye Thomas, L Lemke,David A,William: Principle of cmedicinal chemistry, V.L. Warley Prvt, Ltd, New Delhi

B. Sc. Fifth Semester

DSC – 5C: Chemistry Paper–V

UNIT – I 12 Hours

Acids and Bases: 02 Hours

Definition of acids and bases, Arrhenius theory, Lowry-Bronsted theory, Lewis concept and Lux-Flood theory. HSAB principle and applications

Non-aqueous Solvents: 03Hours

Introduction, physical properties of a solvent, types of solvents and their general characteristics. Reaction in nonaqueous solvents with reference to liquid ammonia, liquid sulphur dioxide, liquid $H_2SO_4$and N_2O_4.

Metallurgy 07 Hours

Introduction: Ore, minerals, important ores of some common elements in India, General Principles of pyrometallurgy, roasting, Calcination, Gangue, Smelting, Flux, Gravity separation, Froth flotation process, leaching. Techniques employed for Purification of metal (Distillation process, Bessemerization, Electro-refining, Van Arkel and De Boer's Filament.

Extraction of metals: Extraction of Manganese (Pyrolusite), Titanium (Ilmenite) and Uranium.

UNIT-II 12 Hours

Carbohydrates: 06 Hours

Introduction and classification. Mechanism of osazone formation, Inter conversion of Glucose into Fructose and vice-versa. Chain lengthening of aldoses (Killiani-Fischer synthesis), chain shortening of aldoses (Wohl degradation). Epimerization and mutarotation. Elucidation of structure of glucose (open chain structure and configuration).

Determination of ring size in glucose (Fischer and Haworth structure of glucose).Haworth structure of sucrose, maltose, lactose

Amino Acids, peptides and proteins: 06 Hours

Introduction, classification and structure of amino acids, Synthesis of α – amino acids (from acids, Strecker synthesis and Gabriel- phthalamide synthesis). Acid-Base behavior and isoelectric point of an amino acid.

Peptides-classification, peptide linkage. Synthesis of a dipeptide (Glycylalanine). Proteins – Classification of proteins on composition and molecular shape. Primary and secondary structures of proteins.

UNIT–III 12 Hours

Electrochemistry –I **08 Hours**

Revision of conduction in metals and electrolyte solutions, Specific conductance, molar conductance, equivalent conductance, variation of equivalent conductance and specific conductance with dilution. Cell constant, determination of equivalent conductance. Ionic conductance, ionic mobility, Kohlrausch's and its applications. Numerical problems.

Application of conductance measurements

a) Solubility and solubility product of sparingly soluble salt

b) Degree of dissociation of weak electrolytes

c) Conductometric titrations: Acid-base and precipitation titrations and advantages of these.

Phase Equilibria: **04 Hours**

Phase rule, definition and explanation of the terms involved in the phase rule. Application to one component system of water, triple point, application to two component system (lead- silver and potassium iodide- water system), Eutectic mixtures and their applications. Freezing mixtures.

UNIT – IV 12 Hours

Spectroscopy: **12 Hours**

Introduction, Electromagnetic radiation. Principle, instrumentation and applications of UV-VIS, FT-IR, NMR spectroscopy in organic analysis. Meaning of the terms chromophore, auxochromophore, bathochromic and hypsochromophoric shifts with examples. Functional, Equivalent and non-equivalent protons, chemical shift, spin-spin coupling, (n+1) rule, Shielding and de-shielding of protons in NMR spectroscopy

Chemistry Paper–V: Blue Print

Sl. No.	Name of the chapter	No. of hours	Marks
1	**Acids and Bases**	02	03
2	**Non-aqueous Solvents**	03	05
3	**Metallurgy**	07	12
4	**Carbohydrates**	06	10
5	**Amino Acids, peptides and proteins:**	06	10
6	**Electrochemistry –I**	08	13
7	**Phase Equilibria**	04	07
8	**Spectroscopy**	12	20
Total		**48**	80

DSC – 5C: Chemistry Practical – V 60 Hours

Organic Chemistry:

Qualitative analysis of binary mixture containing two solid compounds, separation using $NaHCO_3$, NaOH and HCl. Identification of mixture, separation of mixture and analysis of any one component with preparation of derivative.

- Acids: Benzoic, Salicylic, Cinnamic and phthalic acid.
- Phenols: 1-Naphthol, 2-Naphtholand and resorcinol.
- Bases: p-Toluidine, o-Toludine, m-Toludine, Nitroanilines
- Neutral: Naphthalene, Diphenyl, m-dinitrobenzene, Acetanilide.

  The mixture is of A+B, A+N, P+B, P+N and B+N

Inorganic Chemistry:

1. Separation of metal ions of group IV by ascending chromatography.
2. Separation of metal ions of group II by paper chromatography.

3. Separation of Phenols on activated silica gel (TLC).

Note: Qualitative analysis given in the examination.

Physical Chemistry:

Instrumental methods of analysis-I

1. Determination of degree of dissociation of weak electrolyte.
2. Determination of dissociation constant (K_a) of weak electrolyte.
3. Determination of equivalent conductance at infinite dilution of strong electrolyte.
4. Determination of solubility and solubility product of a sparingly soluble salt (say $BaSO_4$, AgCl, AgBr) by conductance method.
5. Determine the amount of Iron in $FeCl_3$ solution and verify the Beer-Lambert's law.
6. Prepare a standard 0.2M N_2HPO_4 and 0.1M citric acid solution, hence prepare DifferentbuffersolutionsanddeterminepKavaluesoftheseunknownsolutions.
7. Determine the P Ka value as of given acid by pH metric titration with strong base.
8. Determine the percentage of cane sugar or tartaric acid solution using polarimeter.

B. Sc. Fifth Semester

SEC – 5C: Chemistry Paper–V

BASIC ANALYTICAL CHEMISTRY (Credits:2) 30 Hours

Unit I: 15 Hours

Chromatography:

General description. Definitions, Terms and parameters used in chromatography, Classification of chromatographic methods. Criteria for selection of stationary and mobile phase, Nature of adsorbents, factors influencing the adsorbents, Nature and types of mobile phases.

Thin layer chromatography (TLC): Principle, Methodology, Determination of Rf value and its significance, Variables that affects Rf values and applications.

Paper chromatography (PC): Definitions, theory and principles, techniques and types of paper chromatography, Methodology, factors affecting Rf values, advantages and applications.

Column chromatography (CC): Basic principle, instrumentations and applications.

Unit II: 15 Hours

Pharmaceutical Chemistry:

Drug discovery, Design and development, Basic retro synthetic approach, Synthesis of the representative drugs of the following classes-analagesics agents, antipyretics agents, anti-inflammatory agents (Aspirin, Paracetamol, Ibuprofen); Antibiotics, (Chloramphenicol), antibactereial and antifungal agents (Sulphanamides, Sulphanethoxazol, Sulphacetamide, trimethoprim.

REFERENCE:

- G.L. Patric: Introduction to medicinal chemistry, Oxford University Press, UK
- Hakishan, V.K.Kapoor: Medicinal and pharmaceutical chemistry, Vallabh Prakashan, Pitampur, New Delhi.
- William O. Foye Thomas, L Lemke,David A,William: Principle of cmedicinal chemistry, V.L. Warley Prvt, Ltd, New Delhi

B. Sc. Six Semester

DSC – 6C: Chemistry Paper–VI

UNIT-I **12 Hours**

INDUSTRIAL CHEMISTRY **08 Hours**

Cement: .

Introduction, definition, raw materials, grades of cement. Manufacture of Portland cement (by dry and wet process). Mechanism of setting of cement. Types of cement and their uses. RCC.

Ceramics, Refractories and glass: Ceramics: Introduction, classification –clay definition, properties and uses. Refractories: classification –acid, base and neutral refractories.

Glass: Properties, types, manufacture of soda glass. Composition and applications of borosilicate, metallic glass, optical glasses and polycarbonate glass, safety glass, fire and bullet proof glass.

Bioinorganic Chemistry: **04 hours**

Introduction, essential and trace elements, non- essential elements, role of Na, K, Mg, Ca, Fe, Co, Ni, Cu and Zn in biological systems. Metalloporphyrins with special reference to hemoglobin, myoglobin and chlorophyll-structure and their functions.

UNIT – II **12 Hours**

Oils, Fats, Soaps and Detergents: **06 Hours**.

Composition of oils and fats. Determination of saponification value and iodine value of oils and fats. Manufacture of soaps (hydrolyser process). Synthetic detergents (Syndets) manufacture of sodium lauryl sulphate and sodium do decyl benzene sulphonate. Cleansing action of soaps.

Drugs and Pharmaceuticals **06 Hours**.

Types of drugs: Definition with Examples (Analgesic, Antipyretic, Anesthetic, Narcotics, Diuretics, Sedatives, Cardiovascular, Antimalarial Anthelmintic, Anticonvulsant, Antiseptic, Antibiotics), Synthesis and uses of Aspirin, Paracetamol, Sulphanilamide, Sulphathiazole and chloramine-T

UNIT-III **12 Hours**

Electro chemistry-II **08 Hours**.

Electrolytic and Galvanic cells, reversible and irreversible cells. Types of reversible electrodes, metal-metal ion electrode, metal- metal insoluble electrode, amalgam electrode, gas electrode and redox electrode. Electrode reactions in Daniel cell. Sign convention of electro de-potential (reduction potential is to be adopted) EMF of the cell and its measurement. Standard electrode potential, Nernst equation for electrode potential and for measuring EMF of the Cell (to be derived). Reference electrodes- calomel electrode, Weston standard cell, Problems on the electrode potential and EMF of the cell, liquid junction potential, Salt bridge.

Application of EMF measurements-Determination of pH of a solution using quinhydrone and glass electrode Potentiometric titrations - Acid -base and redox titrations.

Physical properties and molecular structure: **04 Hours**

Dipole moment, polarization, induced polarization, orientation polarization, measurement of dipole movement by temperature method. Dipole movement and structure of Molecules (CO_2, H_2O, BF_3, NH_3 and CCl_4.

UNIT-IV **12 hours**

Basic Analytical Chemistry **12 hours**

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Determination of pH of soil samples. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. Determination of pH, acidity and alkalinity of a water sample. Determination of dissolved oxygen (DO) of a water sample.

Analysis of food products: Nutritional value of foods, idea about food processing and food preservations and adulteration. Identification of adulterants in some common food items like coffee powder, asafetida, chilli powder, turmeric powder, coriander powder and pulses, etc. Analysis of preservatives

Chemistry Paper-VI: Blue Print

Sl. No.	Name of the chapter	No. of hours	Marks
1	**INDUSTRIAL CHEMISTRY**	08	13
2	**Bioinorganic Chemistry**	04	07
3	**Oils, Fats, Soaps and Detergents**	06	10
4	**Drugs and Pharmaceuticals**	06	10
5	**Electro chemistry**-II	08	13
6	**Physical properties and molecular structure**	04	07
7	**Basic Analytical Chemistry**	12	20
	Grand total	**48**	80

DSC – 6C: Chemistry Practical –VI 60 Hours

Inorganic Chemistry:

Gravimetric estimations:

1. Estimation of iron as ferric oxide in ferrous ammonium sulphate solution.
2. Estimation of barium as barium sulphate in barium chloride solution
3. Estimation of sulphate as barium sulphate in ammonium sulphate solution.
4. Estimation of nickel as nickel dimethyl glyoximate in nickel sulphate solution.
5. Estimation of Magnesium as oxinate in magnesium sulphate solution.
6. Estimation of copper as cuprous thiocyanate in copper sulphate solution.

Organic Chemistry:

Preparations:

1. Preparation of Acetanilide from aniline
2. Preparation of p-bromoacetanilide from Acetanilide
3. Preparation of iodoform from acetone.
4. Preparation of Benzoin from benzaldehyde
5. Preparation of m-dinitrobenzene from nitrobenzene
6. Preparation of p- nitro acetanilide from acetanilide
7. Preparation of Benzoic acid from Benzyl chloride
8. Preparationof2,4,6-tribromoaniline from aniline.

Physical Chemistry:

Instrumental methods of Analysis -II

1. Conductometric titration of strong acid (HCl) against strong base (NaOH)
2. Conductometric titration of weak acid (acetic acid) against strong base (NaOH)
3. Conductometric titration of mixture of acids against strong base
4. Conductometric precipitation titration of sodium chloride against silver Nitrate
5. Determination of amount of cu^{+2} in $CuSO_4$ solution and verify Beer Lambert's law.

6. Determine the specific and molar refractivity of two given liquids by Abbe refractometer and determine the densities of two given liquids.
7. Estimation of HCl by titrating with standard NaOH potentiometrically.

B. Sc. Sixth Semester

SEC – 6C: Chemistry Paper–VI

CHEMISTRY OF COSMETICS AND PERFUMES (Credits 2) **30 Hours**

Unit I: Chemistry of Cosmetics **15 Hours**

A general study including preparation and uses of the followings: Hair dye, Hair spray, Shampoo, Suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours.

Unit II: Chemistry of Perfumes **15 Hours**

A general study including preparation and uses of the followings: Essential oils and their importance in perfume industries with reference to eugenol, geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenylethylalcohol, jasmone, civetone, muscone.

REFERENCES:

- F. Stocchi: Industrial Chemistry, Vol. 1, Ellis Horwood Ltd. UK
- P.C Jain, M. Jain: Engineering Chemistry, Dhana pat Rai & Sons, Delhi
- Sharma, B. K.& Gaur. H, Industrial Chemistry, Goel Publishing House, Meerut (1996)

THEORY EXAMIANTION QUESTION PAPER PATTERN FOR MAJOR SUBJECTS

(Semester I – VI)

B.Sc. Semester- I Degree Examinations: 2024-25

(Semester Scheme: New Syllabus: 2024-25)

SUBJECT: SCIENCE COURSE

Paper _____ : _____

Paper Code: _____

Time : 3 Hours **Max. Marks : 80**

Instructions to candidates:

1All Sections are compulsory
2.Draw neat and labeled diagrams wherever necessary.

SECTION – A

Minimum TWO question from each unit

I Answer all the following questions : **(2 × 10 =20)**

a

b

c

d

e

f

g

h

i

j

SECTION – B
Minimum Two questions from each unit

Answer any SIX of the Following: **(5 × 6 = 30)**

2

3

4

5

6

7

8

Answer Any Three of the Following : (10 x3 = 30)

9. (a + b)/(a+b+c) From Unit-I

5+5/(6+4)/(2+4+4)

10. (a + b)/(a+b+c) From Unit-II

5+5/(6+4)/(2+4+4)

11. (a + b)/(a+b+c) From Unit-III

5+5/(6+4)/(2+4+4)

12. (a + b)/(a+b+c) From Unit-IV

5+5/(6+4)/(2+4+4)

THEORY EXAMINATION QUESTION PAPER PATTERN FOR

ELECTIVE/OPTIONAL PAPERS

(Semesters III & IV)

B.Sc. Semester-I/II/III/IV/V Degree Examination; 2024-25

(Semester Scheme; New Syllabus: 2024-25)

SUBJECT: SCIENCE COURSES

Paper– ELECTIVE / OPTIONAL III & IV_____

Paper Code: _____

Time: 2 Hours **Max. Marks: 40**

Instructions to candidates:

1) All sections are compulsory
2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

Answer **all** the following questions: **(2×5=10)**

1.

2.

3.

4.

5.

SECTION-B

Answer any **SIX** of the following: **(5×6=30)**

6.

7.

8.

9.

10.

11.

12.

13.