JSS COLLEGE FOR WOMEN

(Autonomous)
Saraswathipuram, Mysuru-570 009

CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS

Continuous Assessment and Grading Pattern (CAGP)

2018-19 onwards

CHEMISTRY

FOR B.Sc. DEGREE PROGRAMME

GENERAL REQUIREMENTS

Scheme of Instructions

1. **Title and Commencement**: As per the university guidelines (12 Ref. letter UA2/379/2016-17)

2. Undergraduate programme offered:

2.2 Faculty of Science

I. Bachelor of Science (B.Sc. 6 Semesters)

3. **Semester and Programme Structure**

The credit pattern for the course is L:P

Course structure in chemistry

Semester	Course opted	SEC Course (2 Credits each)	Credits
I	Core course-DSC-2A		4 (L) + 2 (P)=6
II	Core course- DSC-2B		4 (L) + 2 (P)=6
III	Core course- DSC-2C		4 (L) + 2 (P)=6
IV	Core course- DSC-2D		4 (L) + 2 (P)=6
V	Core course- DSE-2A	SEC- 1 and SEC-2	4 (L) + 2 (P)=6+SEC
VI	Core course- DSE-2B	SEC-3 and SEC-4	4 (L) + 2 (P)=6+SEC
		Total Credits	**36 + Credits from SEC**

4. Definitions:

4.1**. DSC**: Discipline Specific Course:

DSE: Discipline Specific Elective

SEC: Skill Enhancement Course

5. Subject Combinations: As per the university guidelines (Ref. letter UA2/379/2016-17)

6. **Eligibility for Admission**

For B.Sc program only those students who have completed PUC or its equivalent examination with Science subjects are eligible.

7. Medium of Instruction: The medium of instruction shall be English/Kannada.

8. Scheme of the Program: As per the university guidelines (Ref. letter UA2/379/2016-17)

9. Course Registration: As per the university guidelines (9.1 to 9.6 Ref. letter UA2/379/2016-17)

10. **Attendance:** As per the university guidelines (10.1 and 10.2 Ref. letter UA2/379/2016-17)

11. Continuous Assessment:

11.1. C1 marks should be considered by conducting a test/ Seminar/Assignment/ Viva/Attendance in the respective topics. C2 marks can be considered by conducting Test/ Seminar/ Assignment/ Viva/ Attendance Dissertation.

11.2. The first component, C1 of assessment is for 10% (includes Theory and Practicals). This should be completed during the eighth week of the semester

11.3. The second component, C2 of assessment is for 10% (includes Theory and Practicals). C2 will be completed during the fifteenth week of the semester.

11.5. As per the university guidelines (11.5 Ref. letter UA2/379/2016-17)

11.6. The scheme of evaluation for C1, C2 and C3 component of the theory and practicals are given in the table below.

Scheme of Examination for DSC and DSE

Credits L : P	**Maximum marks in the C1, C2 and C3 components (I to VI semesters)**			**Duration of examination**
4 : 2	C1 Marks	C2 Marks	C3 Marks	Theory: 3hrs Practical:3 hrs
	Theory:10 Practical:05 Total=15	Theory:10 Practical:05 Total=15	Theory:50 Practical:20 Total=70	
	Grand total = 100			

C3 is final examination Marks.

Note : C3 for theory should be considered by conducting the exam for 70 and later reducing it to 50 marks. C3 for practical should be considered by conducting the exam for 40 and later reducing it to 20 marks.

Scheme of Examination for SEC

Credits L : P	Maximum marks in the examination / Assessment			Duration of examination
2 : 0	C1	C2	C3	2 Hours
	15	15	35	
	Total marks=50			

C3 is final examination conducted for 50 marks and reduced to 35 marks. The average marks of C1 and C2 should be taken and added to C3 marks, and total marks for 50 marks to be allotted.

12. Evaluation of C1 and C2

As per the university guidelines (12 Ref. letter UA2/379/2016-17).

13. Examination and Evaluation for C3

13.1. a) The question paper pattern for C3 component is given below

Question Paper Pattern for DSC (Semester I to IV)

Duration: 3 Hr **Max. Marks: 70**

The question paper contains 5 parts.

Part –A (Compulsory)
Four questions carrying 1 mark each. 6 x 1 = 06

Part –B (Inorganic Chemistry)
Answer any 2 out of 3 questions. 2 x 9 = 18

Part –C (Organic Chemistry)
Answer any 2 out of 3 questions. 2 x 9 = 18

Part –D (Physical Chemistry)
Answer any 2 out of 3 questions. 2 x 9 = 18

Part –E (General Chemistry)
Answer any 2 out of 3 questions. 2 x 9 = 18

Pattern: (5 +(4) / (3 + 3 + 3) / (3 + 2 + 4) / (5+ 2+2) / (6+3)

Question Paper Pattern for DSE (Semester V to VI)

Duration: 3 Hr **Max. Marks: 70**

The question paper contains 4 parts.

Part –A (Compulsory)
Six questions carrying 1 mark each. 10 x 1 = 10

Part –B (Inorganic Chemistry)
Answer any 2 out of 3 questions. 2 x 10 = 20

Part –C (Organic Chemistry)
Answer any 2 out of 3 questions. 2 x 10= 20

Part –D (Physical Chemistry)
Answer any 2 out of 3 questions. 2 x 10= 20

Pattern: 5 +(4) / (3 + 3 + 3) / (3 + 2 + 4) / (5+ 2+2) / (6+3)

Question Paper Pattern for SEC

Duration: 2 Hr **Max. Marks: 50**

Answer any 5 out of 6 questions. 5 x 10 = 50

Pattern: (5+3+2) / (4 + 4 + 2) / (3 + 3+ 4) / (2 + 2 + 3 + 3) / (5 + 5)

b) As per the university guidelines (13 Ref. letter UA2/379/2016-17)

13.2 Valuation: As per the university guidelines (Ref. letter UA2/379/2016-17)

14. As per the university guidelines (14 Ref. letter UA2/379/2016-17)

15. Passing Criteria

15.1. A student is considered to have passed the course, only on securing a minimum of 40% from C1, C2 and C3 put together from Theory and Practical.

15.2. A student can take C3 exam irrespective of the marks scored in C1 and C2 of a particular course

15.3. In case a student secures less than 30% in C3 or absent for C3, the student is said to have not completed the course. The student shall complete the course by reappearing only for C3 component of that course when university conducts.

15.4. As per the university guidelines (15. Ref. letter UA2/379/2016-17)

16. Makeup examination: As per the university guidelines (16. Ref. letter UA2/379/2016-17)

17. Percentage and Grading: As per the university guidelines (17 Ref. letter UA2/379/2016-17)

18 to 22. As per the university guidelines (Ref. letter UA2/379/2016-17)

I SEMESTER

CHEMISTRY –I (DSC-2A)

CLASS DURATION – THEORY: 04 HOURS/WEEK

PRACTICALS: 04 HOURS/WEEK

Theory and Practicals: 64 Hours each-Total Credits-06 (Theory-04, Practicals-02)

Discipline Specific Course (DSC-2A Chemistry) is a core course for I semester, which should be compulsorily studied by a student as a core requirement of the programme.

UNIT-I: Inorganic Chemistry

Atomic Structure: Review of Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's equation-derivation, Heisenberg's uncertainty principle. Hydrogen atomic spectra. Need of a new approach to Atomic structure. **[3 hours]**

Elements of Quantum chemistry- Schrodinger wave equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom.

Radial and angular parts of the hydogenic wave functions (atomic orbitals) and their variations for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation). Radial and angular nodes and their significance.

Quantum numbers and their Significance. Shapes of *s*, *p* and *d* atomic orbitals, nodal planes.

Rules for filling up of electrons in various orbitals (Aufbau principle, Pauli's exclusion principle, Hund's rule of maximum multiplicity and n+l rule), Electronic configuration of the elements (up to Z=30) and anomalous electronic configurations.

Stability of half-filled and completely filled orbitals- concept of pairing and exchange energy.

[6 hours]

Periodic Table and Periodicity: Classification of elements into s, p, d, and f-blocks, cause of periodicity.

Atomic radius: Covalent, ionic, van der Waal's and crystal radii. Additive nature of covalent radii. Determination of ionic radii by Lande's method. Variation of covalent radii in a group and in a period- explanation for the observed trends. Comparison of the size of atoms with their corresponding anions and cations, variation of ionic radii in isoelectronic ions.

Ionization enthalpy: Successive ionization enthalpy, factors affecting ionization enthalpy, applications of ionization enthalpy. Variation in a group and in a period – explanation for the observed trends.

Electron gain enthalpy: Successive electron gain enthalpy, variation of electron gain enthalpy in a period and in a group- explanation for the observed trends.

Electronegativity: Variation of electronegativity in a group and in a period- explanation for the observed trends. Factors determining electro negativity (charge on the atom and hybridization). Pauling, Mulliken and Alfred-Rochow scale of electronegativity. Applications of electronegativity. [7 **hours]**

UNIT-II : Organic Chemistry

Basic Concepts in Organic Chemistry: Bond cleavage, reactive intermediates, Generation, stability and reactions involving carbocations, carbanions, free radicals, nitrenes and carbenes.

[**3 hours]**

Types of organic reactions: Definition with examples of addition, substitution, elimination, isomerisation, condensation and rearrangement reactions with examples. [**2 hours]**

Electronic effects : Electronic displacement effects: Inductive Effect, Electromeric Effect, Resonance, Hyperconjugation and their significance. [**3 hours]**

Alkanes: Preparation by Corey-House reaction, conversion of alkanes to aromatic compounds via alkenes and alkynes- aromatization and pyrolysis.

Alkenes: Preparation of alkenes by Wittig's reaction, Hoffmann's elimination, Stereoselectivity. Mechanism of electrophillic addition, oxymercuration, reduction, hydroboration – oxidation and epoxidation. Mechanism of oxidation with $KMnO_4$ and OsO_4, ozonolysis. Industrial applications of ethene and propene.

Dienes: Types, relative stabilities of dienes, conjugated dienes – 1,3 butadiene-structure, 1,2 and 1,4-addition reactions with H_2 and halogens, Diel's Alder reaction with an example.

Alkynes: Methods of preparation – Dehydrohalogenation, vicinal and gem dihalides, reactions of alkynes – Electrophillic additions with HCN, CH_3COOH and H_2O polymerization.

[8 **hours]**

UNIT-III : Physical Chemistry

Indicators: Definition, types (acid-base, redox, adsorption indicators), examples for each type. Theory of indicators – Oswald's theory and Quinonoid theory – indicator constant – action of phenolphthalein and methyl orange in acid-base solutions – pH titration curves for strong acid vs

strong base, weak acid vs strong base, weak base vs strong acid, choice of indicators in these types of titrations. Calculation of pH in mixture of acid and base. **[5 hours]**

Liquid mixtures: Classification of binary mixtures – partially miscible, completely miscible and completely immiscible pairs of liquids (explanation with examples for each type).

Partially miscible liquids: Critical solution temperature (CST) – types – phenol-water system, triethylamine-water system, nicotine-water system (mutual solubility temperature (MST) vs composition curves to be drawn). Effect of addition of non-volatile solute on CST. Binary mixtures of completely miscible liquids.

Vapour pressure – definition, vapour pressure – composition diagrams and boiling point – composition diagrams. Classification into the types – obeying Raoult's law (type I), showing positive deviation from Raoult's Law (type II) and showing negative deviation from Raoult's Law (type III) – examples for each type.

Principles of fractional distillation: Fractional distillation of type I, type II and type III liquid mixtures (with examples). Azeotropic mixtures (definition).

Binary mixtures of completely immiscible liquids (with examples), weight fraction of distillates (no derivation), principle of distillation, applications (numerical problem on weight fractions of components). **[7 hours]**

Distribution Law: Nernst distribution law – statement, distribution coefficient, verification of distribution law taking distribution of I_2 in H_2O and CCl_4 – limitations of the law, conditions for the validity of distribution law, association of the solute in one of the solvents, dissociation of the solute in one of the solvents, application of distribution law with respect to solvent extraction process (numerical problems) **[4 hours]**

UNIT-IV: General Chemistry

Purification of compounds: Crystallisation, fractional crystallization, distillation, steam distillation, fractional distillation and distillation under reduced pressure, sublimation techniques with suitable examples. **[4 hours]**

Stoichiometry : Mole concept, Concentration terms: normality, molarity, molality, molefraction and ppm(Problems to be worked). Calculation of equivalent mass (acids, bases, salts, oxidising and reducing agents) and oxidation number of element in a molecule. Applications of oxidation number, balancing of redox reactions by oxidation number method. Oxidation number and valency (comparison). **[8 hours]**

Introduction to organic chemistry- Definition and importance of organic compounds to life and applications in food, fuels, textiles, dyes, drugs and cosmetics with examples. Nomenclature(IUPAC) of bifunctional, aliphatic and aromatic compounds. [**4 hours]**

I Semester Practicals

CHEMISTRY-DSC 2A LAB

VOLUMETRIC ANALYSIS

Practical duration: 1 practical per week of 4 hrs

64 Hours (Credits: 02)

Acidimetry/Alkalimetry Titrations:

1. Preparation of standard sodium carbonate solution and standardization of hydrochloric acid solution (methyl orange indicator). Estimation of sodium hydroxide present in the solution using phenolphthalein indicator.
2. Preparation of standard oxalic acid solution and standardization of sodium hydroxide solution. Estimation of sulphuric acid present in the solution.
3. Preparation of standard potassium biphthalate solution and standardization of sodium hydroxide solution. Estimation of oxalic acid present in the solution.
4. Estimation of NaOH and Na_2CO_3 in a mixture (or caustic soda) by double indicator method using approximately 0.1N HCl.
5. Estimation of ammonium chloride using 0.05N sodium hydroxide and 0.1N hydrochloric acid solutions (back titration).

Permanganometry Titrations:

6. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of ferrous ammonium sulphate present in the solution.
7. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of hydrogen peroxide present in the solution.
8. Estimation of sulphuric acid and oxalic acid in a mixture using standard sodium hydroxide and standard potassium permanganate solutions.

Dichrometry Titrations:

9. Preparation of std. potassium dichromate solution and estimation of ferrous ammonium sulphate present in the solution using potassium ferrocyanide as an external indicator.

10. Estimation of ferrous and ferric iron in a given mixture using standard potassium dichromate solution.
11. Preparation of standard FAS and estimation of potassium dichromate solution using N-phenyl anthranilic acid as an indicator.

Iodometry Titrations-

12. Determination of BOD in sewage water.
13. Determination of dissolved oxygen in sewage water.
14. Estimation of copper in $CuSO_4$ using potassium dichromate crystals and approximately 0.1N sodium thiosulphate solution.

Complexometric Titration-

15. Preparation of zinc sulphate solution and standardization of EDTA. Estimation of total hardness of water.

II SEMESTER

CHEMISTRY –II (DSC-2B)

CLASS DURATION – THEORY: 04 HOURS/WEEK

PRACTICALS: 04 HOURS/WEEK

Theory and Practicals: 64 Hours each-Total Credits-06 (Theory-04, Practicals-02)

Discipline Specific Course (DSC-2B Chemistry) is a core course for II semester, which should be compulsorily studied by a student as a core requirement of the programme.

UNIT-I: Inorganic Chemistry

Chemical Bonding and Molecular Structure

Ionic Bonding: Definition and explanation with suitable examples. General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability.

Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. **[5 hours]**

Covalent bonding: Definition and explanation with suitable examples, factors favouring the formation of covalent bond. Valence bond approach - Shapes of some inorganic molecules and ions on the basis of VSEPR theory(NH_3, H_2O,SO_4^{2-} & ClO_4^-). Hybridization of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements($BeCl_2$, BF_3, $[Ni(CN)_4]^{2-}$, $SiCl_4$, PCl_5 and SF_6 respectively). **[4 hours]**

Concept of resonance and resonating structures in various inorganic compounds and ions (CO, CO_2, N_2O, SO_3^{2-}, CO_3^{2-}). **[2 hours]**

MO approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (H_2, He_2,

He_2^+, N_2, O_2 and F_2) (including idea of *s-p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches. [**5 hours]**

UNIT-II : Organic Chemistry

Cycloalkanes: Sache-Mohr theory. Conformation of cyclopentane and cyclohexane, mono and disubstituted cyclohexane. Conformational analysis of butane and ethylene glycol with energy profile diagram. [**4 hours]**

Aromatic hydrocarbons: Nomenclature of benzene derivatives, Huckel's rule with respect to benzenoids, (benzene, naphthalene, anthracene and phenanthracene) and non-benzenoid compounds (cyclopentadienyl anion, cycloheptadienyl cation) anti-aromaticity. Annulenes (14 to 18 carbon atoms)

Aromatic electrophillic substitution – General mechanism, electronic interpretation of orientating influence of electron donating groups (-CH_3, -Cl, -NH_2 and -OH groups) and electron withdrawing groups (-NO_2, -CHO, -COOH and –SO_3H groups) on electrophillic substitution reactions. [**4 hours]**

Hydrogenation of aromatic compounds: Birch reduction, side chain oxidation of toluene to benzaldehyde and benzoic acid. Resonating structures of benzene, naphthalene and anthracene. Diel's Alder reactions of anthracene with maleic anhydride.

Biphenyls: Preparation – Ullmann reaction.

Alkenyl Benzenes: Preparation of stilbene (one method), Cis-trans isomers of stilbene [**4 hours]**

Organic halides: Alkyl halides: isomerism and classification, elimination reaction: dehydrohalogenation. Saytzeff rule, Nucleophilic substitution reaction. S_N^1 and S_N^2 with energy profile diagram. Effect of nature of alkyl groups, nature of leaving groups, nucleophiles and solvents. [**4 hours]**

UNIT-III: Physical chemistry

Chemical Kinetics: Introduction – differential and integrated rate equations for second order kinetics, derivation of second order rate equation when a=b and a≠b, unit of rate constant, half-life period, problems. Experimental verification of second order reactions – study of kinetics of saponificaiton of an ester, determination of the order of reaction – differential, time for half-change method and isolation method. Effect of temperature on rate of a reaction, Arrhenius

equation, concept of activation energy, problems. Theories of reaction rates-simple collision theory and transition state theory, comparison of two theories. Experimental methods of chemical kinetics, conductometric – example - saponification of esters and spectrophotometric – example – colorimetric study of kinetics of oxidation of Indigocarmine by chloramine-T.

[**9 hours]**

Ionic equilibria: Debye-Huckel theory of strong electrolytes (relaxation time effect, electrophoretic effect and viscous effect). Debye-Huckel-Onsagar equation (no derivation), Debye-Huckel Limiting equation for activity coefficients (no derivation). Hydrolysis of salts – (four types) derivation - degree of hydrolysis and its relationship with K_h, effect of temperature and dilution on degree of hydrolysis. Relationship between K_h, K_w, K_a and K_b. pH of salt solutions and problems. [**7 hours]**

UNIT-IV: General Chemistry

Preparation and synthetic applications of organic reagents – acetyl chloride, acetic anhydride, benzoyl chloride, Raney Nickel, Dimethyl sulphate, Lithium aluminium hydride. [**2 hours]**

Polymers: Introduction, monomer, repeating units, types (linear, branches and network) with examples, degree of polymerization, classification (arrangement and shape) with examples, polymerization reaction (addition and condensation), molar masses of polymers – types (number average and mass average), determination of molar mass (viscosity and osmotic pressure method) (Numerical problems). [**6 hours]**

Organic reagents in inorganic analysis- Advantages of organic precipitants over inorganic precipitants, DMG, 8-hydroxy quinoline (Oxine), 1,10-phenanthroline and EDTA. Structure of Ni^{2+}-DMG and Mg^{2+}-oxine complexes. [**3 hours]**

Soaps, detergents and waxes : definition and types of soaps, manufacture of soap by hot process, cleansing action of soap. Detergents, types with examples. Differences between soaps and detergents. Waxes – Definition, types with examples. [**5 hours**]

II Semester Practicals

CHEMISTRY-DSC 2B LAB

Practical duration: 1 practical per week of 4 hrs

64 Hours (Credits: 02)

SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS AND ORGANIC PREPARATION

Part 1: Systematic qualitative organic analysis of the following compounds (Minimum10 compounds).

1. Acids
2. Alcohols
3. Aldehydes
4. Amides
5. Amines
6. Halogenated hydrocarbons
7. Hydrocarbons
8. Ketones
9. Nitro compounds
10. Phenols

Part 2: Organic preparations: Recrystallisation and determination of melting point and its importance may be mentioned

1. Acetylation : Preparation of acetanilide from aniline.
2. Oxidation: Preparation of benzoic acid from benzaldehyde.
3. Nitration : Preparation of m-dinitrobenzene from benzene.
4. Hydrolysis : preparation of benzoic acid from ethyl benzoate.
5. Bromination : Preparation of 2,4,6-tribromophenol.
6. Glucosazones : extraction of glucose from cane sugar.
7. Diazotization : preparation of methyl orange.

Note: Preparation-equation, recrystallisation, theoretical and practical yield.

III SEMESTER

CHEMISTRY –III (DSC-2C)

CLASS DURATION – THEORY: 04 HOURS/WEEK

PRACTICALS: 04 HOURS/WEEK

Theory and Practicals: 64 Hours each-Total Credits-06 (Theory-04, Practicals-02)

Discipline Specific Course (DSC-2C Chemistry) is a core course for III semester, which should be compulsorily studied by a student as a core requirement of the programme.

UNIT-I: Inorganic Chemistry

Chemistry of transition elements: Position in the periodic table, electronic configuration, general characteristics- atomic and ionic radii, ionization energy, variable oxidation states, spectral properties, redox potentials, colour and magnetic properties, catalytic activity, complex formation and interstitial compounds formation (3d, 4d and 5d series).

Chemistry of inner transition elements: Electronic configuration and position in the periodic table, oxidation states, spectral properties, colour and magnetic properties, complex formation and ionic radii, lanthanide contraction – cause and its consequences. General survey of actinides – comparison with lanthanides, transuranic elements. [**10 hours]**

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. [**6 hours]**

UNIT-II: Organic Chemistry

Alcohols: Definition and classification.

Monohydric alcohols: Preparation of alcohols by Hydroboration-oxidation method. Hydration of alkenes. Distinction tests between 1°, 2°, and 3° alcohols by Victor Meyer and oxidation method. Conversion of 1° to 2°, 2° to 3° and 1° to 3° alcohols. Dehydration of 1°, 2°, 3° alcohols and comparison of their rates.

Dihydric alcohols: Glycol – preparation from vicinal dihalides and uses. Pinacoles – synthesis, mechanism of pinacol-pinacolone rearrangement

Trihydric alcohols: Glycerol, synthesis from propene, reactions with HNO_3, H_2SO_4, oxalic acid and HI. Uses of glycerol. **[4 Hours]**

Phenols: Definition, classification with examples, acidity of phenols, effect of substituents on acidity of phenols. Mechanism of Reimer-Tiemann reaction and Kolbe reaction. Fries and claisen rearrangement with examples. conversion of phenol to phenolphthalein and fluoroscein.

[4 Hours]

Ethers: Nomenclature, Williamson ether synthesis, reactions – cleavage and auto-oxidation-Ziesel's method.

Epoxides: Synthesis by Darzen's method. Acid and base catalyzed opening of epoxides.

Crown ethers: Introduction with examples. **[4 Hours]**

Carbonyl Compounds: Distinction between aldehydes and ketones – oxidation and reduction method. Addition of alcohols- formation of hemiacetal and acetal. Condensation with NH_2OH and 2,4-DNP. Mechanism of aldol condensation, Perkins reaction, Cannizzaro reaction, Claisen condensation, Knovenagel reaction. **[4 Hours]**

UNIT-III: Physical Chemistry

Second law of thermodynamics: Limitations of First Law of Thermodynamics – need for II Law of thermodynamics, spontaneous, non-spontaneous and equilibrium processes (definitions and examples for each), different ways of stating II Law, concept of entropy – definition and physical significances of entropy – criteria of spontaneity in terms of entropy change, statements of II law in terms of entropy.

Free energy: Helmholtz and Gibb's free energy – their definitions and their relationship, Gibb's – Helmholtz equation at constant pressure and volume (derivations), thermodynamic criteria of equilibrium and spontaneity, variation of free energy with temperature and pressure, Claussius – Clappeyron equation (differential form to be derived), integrated form of Claussius – Clappeyron equation (to be assumed) and its applications (enthalpy of vapourization, boiling point and freezing point at different temperatures), (numerical problems on these applications)

Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. **[7 Hours]**

Crystallography: Amorphous and Crystalline solids, differences. Crystal systems and their characteristics, Elements of symmetry – plane, axis and centre, elements of symmetry in cubic crystals, law of rational indices – Weiss and Miller indices, Crystal systems and their characteristics,Crystal lattice and unit cell, types of Lattice – Bravais lattices, X-Ray diffraction and Bragg's Law (to be derived), determination of crystal structure of rock salt by rotating crystal method using Bragg's spectrometer, Structure of NaCl, KCl & CsCl (only qualitative), application of X-ray studies – distance between lattice planes, density of crystals, determination of Avogadro Number (numerical problems on applications), Qualitative treatment of Nernst heat theorem and III law of thermodynamics-statement only.

Liquid Crystals: Defintion, classification of thermotropic liquid crystals into smectic, nematic and cholesteric with examples-molecular arrangement of these and their uses. **[9 Hours]**

UNIT-IV: General Chemistry

Chromatography: Paper: introduction to ascending, descending and circular, R_f value and it's applications

TLC: Introduction and applications

Column Chromatography: Introduction, principle and experimental details and applications

Gas Chromatography: Introduction, apparatus, programmed temperature gas chromatography, quantitative analysis of GLC

HPLC: Introduction, schematic diagram of instrumentation and application. **[5 Hours]**

Energy sources-Dry cell, lead storage battery, solar cell and fuel cell. **[3 Hours]**

Nanotechnology: Definition, uses and nature of nanotechnology, **Nanomaterials**-definition, properties and applications, **Carbon nanotubes**- definition, types, methods of preparation (mention), properties and industrial applications of carbon nanotubes, **Nanowires**-definition, types, production of crystalline nanowires by vapour-liquid-solid synthesis method, applications of nanowires. [**4 Hours]**

Amino acids and proteins: Structure, classification with examples, peptide bond, N-protecting & C-protecting groups, peptide synthesis (Gly-Gly, Gly-Ala)

Proteins-types-based on functional properties. Denaturation, colour reaction (Biuret, Ninhydrin and Millon's test) **[4 Hours]**

III Semester Practicals

CHEMISTRY-DSC 2C LAB

Practical duration: 1 practical per week of 4 hrs

64 Hours (Credits: 02)

QUALITATIVE ANALYSIS OF INORGANIC SALT MIXTURE AND INORGANIC PREPARATION

Part 1: Systematic semi-micro Qualitative Analysis of Inorganic Salt Mixture containing two cations and two anions (Minimum 10 mixtures to be analysed).

The constituent ions in the mixture to be restricted to the following.

Anions: HCO_3^-, CO_3^{2-}, SO_4^{2-}, Cl^-, Br^-, NO_3^-, BO_3^{3-}, SO_4^{2-} and PO_4^{3-}

Cations: Pb^{2+}, Bi^{3+}, Cd^{2+}, Al^3+, Fe^{3+}, Fe^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, K^+, Na^+ and NH_4^+

Note:

1. Mixtures requiring elimination of phosphate and borate should not be given.
2. Combination like Cl^- and Br^-, NO_3^- and Br^- shall be avoided.
3. Salts that yield double decomposition shall be avoided (like $CaSO_4$, $BaSO_4$, $PbSO_4$, $FeSO_4$).
4. The combination of two cations in the mixture should belong to different groups. However combinations like Mg^{2+} and NH_4^+ and Na^+ and NH_4^+ can be given.

Part 2: Inorganic preparations

1. Preparation of Chloropentaminecobalt(III)chloride.
2. Preparation of Cuprammoniumsulphate
3. Preparation of Ferric alum
4. Preparation of ferrousoxalate.
5. Preparation of Prussian blue (ferri ferrocyanide).

IV SEMESTER

CHEMISTRY –IV (DSC-2D)

CLASS DURATION – THEORY: 04 HOURS/WEEK

PRACTICALS: 04 HOURS/WEEK

Theory and Practicals: 64 Hours each-Total Credits-06 (Theory-04, Practicals-02)

Discipline Specific Course (DSC-2D Chemistry) is a core course for IV semester, which should be compulsorily studied by a student as a core requirement of the programme.

UNIT I : Inorganic Chemistry

Coordination Chemistry: Ligands, classification of ligands and chelation, nomenclature of co-ordination compounds, physical methods in the study of complexes – change in conductance, colour and pH. Stability of complexes – stability constant, a brief outline of thermodynamic stability of metal complexes, factors affecting the stability of complexes. Polynuclear complexes, inner metallic complexes.

Applications of complexes: Cis platin in cancer therapy, $Na_2CaEDTA$ in treatment of heavy metals (Pb & Hg) poisoning.

Isomerism in co-ordination complexes: Stereo-isomerism – Geometrical and optical isomerism exhibited by co-ordination compounds of co-ordination number 4 and 6. [**7 hours]**

Valence bond theory: Salient features, formation of octahedral complexes on the basis of VBT, outer and inner orbital octahedral complexes- $[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$, $[Co(CN)_6]^{3-}$, $[CoF_6]^{3-}$ $[Cr(H_2O)_6]^{3+}$ and $[Fe(H_2O)_6]^{2+}$. Formation of tetrahedral and square planner complexes on the basis of VBT – $[Ni(CN)_4]^{2-}$, $[Cu(NH_3)]^{2+}$, $[Zn(NH_3)_4]^{2+}$and $[Ni(CO)_4]$, limitations of VBT.

[**4 hours]**

Crystal field theory: Important features of crystal field theory, crystal field splitting of d-orbitals in tetrahedral, octahedral and square planar complexes, crystal field stabilization energy (CFSE), factors affecting the magnitude of Δ_o, (nature of ligand, oxidation state of the metal ion, size of the orbitals, geometry of the complex), high spin (HS) and low spin (LS) complexes, magnetic properties of metal complexes based on crystal field theory-$[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-}$, $[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$ and $[Ni(CN)_4]^{2-}$. Magnetic susceptibility, measurement of magnetic moment by Gouy's method. Limitations of CFT.

Ligand field theory: Evidences for metal ligand covalent bonding in complexes. **[5 Hours]**

UNIT II: Organic Chemistry

Stereochemistry: Introduction, definition, elements of symmetry (plane, centre, simple axes and alternative axes), asymmetry and dissymmetry, Chirality, designation of configuration (D-L and R-S). Optical activity – explanation – cause of optical activity (non-super impossibility). Enantiomers and diastereomers optical isomerism in tartaric acid and biphenyl compounds, racemisation, resolution, methods of resolution (Chemical and biochemical methods) Walden inversion, asymmetric synthesis (partial and absolute).

Geometrical isomerism: Definition with example, designation of cis-trans and E-Z notations with examples. Characteristics of geometrical isomers, Identification of geometrical isomers. Geometrical isomerism in aldoximes and ketoximes, Beckmann rearrangement with mechanism.

[8 Hours]

Carbohydrates: Definition and importance, classification based on composition with examples-reducing and non-reducing sugars.

Monosaccharides: Glucose: reactions of glucose (with H_2N-OH, HCN, $C_6H_5NHNH_2$, Br_2 water, Conc. HNO_3, reductions with HI/red P , methanol/dry HCl, acetic anhydride and reduction reactions.

Structural elucidation of glucose: Open chain structure, configuration, drawbacks of open chain structure, ring structure – Fisher and Haworth structure. Determination of ring size by methylation method.

Structural elucidation of fructose: Reactions of fructose, Fischer and Haworth structures, Fischer and Haworth structures of galactose and mannose.

Conversion reactions – 1. Ascending (Kiliani's synthesis) 2. Descending (Wohl's degradation) 3. Aldose to ketose 4. Ketose to Aldose 5. Epimerisation

Disaccharides: Structural elucidation of sucrose, structural formulae of maltose and lactose (Haworth structure).

Polysaccharides: Partial structural formulae of starch, cellulose, glycogen and their uses.

[8 **Hours]**

UNIT III: Physical Chemistry

Elementary Quantum Mechanics: black body radiation – Planck's Law, Photoelectric effect, Compton effect, Schrodinger's wave equation (no derivation) and its importance, Eigen function

and Eigen values, significance of Ψ and Ψ^2, particle in one dimensional box (derivation), operators-linear, ∇ and ∇^2 and Hamiltonian operator. **[5 Hours]**

Electrochemistry-I: Introduction, conductance – specific conductance, equivalent conductance and molar conductance – their definitions and SI units. Conductivity cell and cell constant. Determination of equivalent conductance by meter – bridge method, ionic mobility, ionic conductance, Kohlrausch's law and its significance – determination of equivalent conductance at infinite dilution for weak electrolyte.

Transport number: Definition and explanation, anomalous transport number – explanation with examples – relationship between ionic conductance and transport number (to be derived), determination of transport number by moving boundary method – transport number of H^+ using $CdCl_2$ as supporting electrolyte (numerical problems on equivalent conductance, transport numbers and kohlrausch's law). **[7 Hours]**

Application of conductance measurements – (a) solubility and solubility product of sparingly soluble salt, (b) ionic product of water, (c) degree of ionization of weak electrolyte. Numerical problems.

Conductometric titration: strong acid vs strong base, weak acid vs strong base, strong acid vs weak base, weak acid vs weak base, with suitable examples for each. **[4 Hours]**

UNIT IV : General Chemistry

HSAB: Classification of acids and bases as Hard and Soft. Pearson's HSAB concept, acid-base strength, hardness and softness, symbiosis. **[3 Hours]**

Gravimetry: Introduction to gravimetric analysis – precipitation methods (various steps involved to be discussed), advantages of gravimetric analysis, purity of the precipitates, co-precipitation and post-precipitation, conditions of precipitation, precipitation from homogeneous solution (hydroxides and sulphates), washing and ignition of precipitate (general discussion only). Electro-gravimetric analysis-estimation of copper. [**4 Hours]**

Dyes: Colour and constitution, chromophore - Auxochrome theory, classification of dyes based on chromophore present and applications with examples, synthesis of indigo, malachite green, congo red, structural elucidation of alizarin and its synthesis. **[4 Hours]**

Physical Properties and chemical constitution: Additive and constitutive properties, properties of liquids – viscosity, definition of coefficient of viscosity, factors affecting viscosity –

temperature, size and weight of molecules, intermolecular forces, determination of viscosity of liquids by Ostwald's method.

Surface tension: Definition, effect of temperature and solute on surface tension, determination of surface tension of liquids using stalagmometer.

Parachor: Definition – Sugden equation, calculation of parachor and its application with respect to structural elucidation of benzene and quinone, numerical problems based on surface tension, viscosity and parachor applications. **[5 Hours]**

IV Semester Practicals

CHEMISTRY-DSC 2D LAB

Practical duration: 1 practical per week of 4 hrs

64 Hours (Credits: 02)

Part 1:

1. Determination of the density using specific gravity bottle and viscosity of a liquid using Ostwald's viscometer.
2. Determination of the density using specific gravity bottle and surface tension of a liquid using stalagmometer.
3. Determination of molecular mass of a non-volatile solute by Walker-Lumsden method.
4. Determination of rate constant of the decomposition of hydrogen peroxide catalyzed by $FeCl_3$.
5. Determination of transition temperature of the salt hydrates($Na_2S_2O_3$,$SrCl_2$,CH_3COONa).
6. Determination of percentage composition of sodium chloride solution by determining the miscibility temperature of phenol - water system.
7. Estimation of the given strong acid using strong base by thermometric titration method [HCl X NaOH].
8. Study of kinetics of reaction between $K_2S_2O_8$ and KI, 2^{nd} order, determination of rate constant.

Part 2: Organic Estimations:

1. Estimation of glucose by Fehling solution method.
2. Estimation of ascorbic acid by iodometric method.
3. Determination of Iodine value of oils by chloramine-T.
4. Isolation of Caffeine from tea powder.
5. Estimation of neutral amino acids by titrametric method.
6. Estimation of carboxylic acid by titrametric method.
7. Determination of saponification value of oils.

V SEM

ESTER

CHEMISTRY –V (DSE-2A)

CLASS DURATION – THEORY: 04 HOURS/WEEK

PRACTICALS: 04 HOURS/WEEK

Theory and Practicals: 64 Hours each-Total Credits-06 (Theory-04, Practicals-02)

Discipline Specific Elective (DSE-2A Chemistry) is a course for V semester offered under the main Disciple/Subject of study or a Project/Dissertation, which should be compulsorily studied by a student as a core requirement of the programme

UNIT I: Inorganic Chemistry:

INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

Silicate Industries

Glass: Raw materials, glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

Cement: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cement. **[9 hours]**

Fertilizers:

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate. **[5 hours]**

Surface Coatings:

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint,

Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing. **[7 Hours]**

Learning outcomes of practical chemistry-IV (fourth semester)- DSC 2D:

UNIT II: Organic Chemistry

Terpenes: Definition, isoprene rule, classification, isolation (solvent extraction and steam distillation) structural elucidation of citral and its synthesis, structural formulae of α-terpeniol, camphor and menthol. **[4 Hours]**

Heterocyclic Compounds: Definition, classification with examples, synthesis of furan, thiophene, pyrrole, pyridine, indole (Fischer method) quinoline (Skrup's synthesis with mechanism), isoquinoline, pyrimidine (one method each), aromaticity and basicity of pyrrole and pyridine. Electrophillic substitution reactions of pyrrole and pyridine.

Uric acid: Elucidation of structure and synthesis by Fischer's method, conversion of uric acid to purine and caffeine

Alkaloids: Definition, classification based on heterocyclic rings-isolation, synthesis and structural elucidation of nicotine and morphine, physiological importance of alkaloids.

[8 Hours]

Vitamins: Definition, classification, structural elucidation and synthesis of Vit-A, Synthesis of Vit-C, structural formulae of Vit B_1, B_2, B_6, calciferol, E and K and their importance.

Hormones: Definition, classification, synthesis of adrenaline, thyroxine, structural formulae of estradiol, progesterone and testosterone and their importance.

Drugs: Chemotherapy and chemotherapeutic agents, definition of drugs, types of drugs, antipyretics, analgesics, anesthetics, sedatives, narcotics, antiseptics, antibacterials, antibiotics, antimalarials and sulpha drugs with examples. Synthesis of paracetamol, sulphanilamide, sulphaguanidine. **[9 Hours]**

UNIT III: Physical Chemistry

Spectrophotometry and photochemistry: Lambert – Beer's law – statement and mathematical form (to be derived). Molar extinction coefficient – definition – spectrophotometer – construction and working, its application.

Laws of photochemistry – Grotthus-Draper law of photochemical activation and Einstein's law of photochemical equivalence, quantum efficiency, reasons for low quantum yield (HBr

formation as example) and high quantum yield (HCl formation as example), actinometry – Uranyl oxalate actinometer.

Photophysical processes: Definition with examples – photosensitization (eg. photosynthesis in plants), photo inhibition, fluorescence, phosphorescence, chemiluminescence and bioluminescence with examples. Determination of absorbed intensity – schematic diagram of apparatus used. Detectors – thermopile, photoelectric cell. **[7 Hours]**

Radiation Chemistry: Definition, primary and secondary stages in radiochemical reactions, ionic yield, energy yield, comparison with photochemistry, units of radiation – rad, gray and roentgen, Dosimeter – Fricke dosimeter, theories of radiolysis – Lind's and EHT theories. Radiolysis of water vapour, benzene and acetic acid. **[3 Hours]**

Molecular Spectroscopy: Regions of spectra, types of spectra, microwave spectra – rotational spectra of diatomic molecules, moment of inertia (expression to be derived). Expression for rotational energy, selection rule and transition equal spacing between rotational spectral lines (to be discussed), effect of isotopic substitution taking example of $^{12}C^{16}O$ and $^{13}C^{16}O$, calculation of bond length.

IR Spectra – vibrational spectra of diatomic molecules – force constant (no derivation), expression for vibrational energy, zero point energy, selection rule and transitions. Vibrational modes of polyatomic molecules taking H_2O and CO_2 molecules as example. Applications of IR spectroscopy (mention).

Raman Spectra: Concept of polarizability, pure rotation, vibration (qualitative study) stoke's and antistoke's lines, selection rule, applications (mention)

Electronic Spectra: Potential energy curves for bonding and antibonding molecular orbitals, band theory, electronic transitions, qualitative description of non-bonding orbitals and transition between them. Selection rule and Franck Condon principle. **[12 Hours]**

V Semester Practicals

CHEMISTRY-DSE-2A LAB

Practical duration: 1 practical per week of 4 hrs

64 Hours (Credits: 02)

Gravimetric Estimations:

1. Gravimetric estimation of barium as barium sulphate.
2. Gravimetric estimation of iron as iron (III) oxide.
3. Gravimetric estimation of copper as copper (I) thiocyanate.
4. Gravimetric estimation of nickel as nickel dimethylglyoximate.
5. Gravimetric estimation of magnesium as magnesium -8-hydroxy oxinate.
6. Gravimetric estimation of sulphate as barium sulphate.
7. Gravimetric estimation of aluminum as aluminum oxide.
8. Gravimetric estimation of zinc as zinc oxide.

Ore analysis:

9. Preparation of standard potassium dichromate solution and estimation of iron in the given sample of hematite by dichromate method.
10. Estimation of percentage of calcium in limestone by oxalate method.
11. Estimation of manganese in the given sample of pyrolusite.
12. Estimation of magnesium in the given sample of dolomite by EDTA method.

Alloy Estimations:

13. Estimation of copper in bronze by iodometric method.
14. Estimation of tin in solder using EDTA.
15. Estimation of aluminium in Duralumin.

VI SEMESTER

CHEMISTRY –VI (DSE-2B)

CLASS DURATION – THEORY: 04 HOURS/WEEK

PRACTICALS: 04 HOURS/WEEK

Theory and Practicals: 64 Hours each-Total Credits-06 (Theory-04, Practicals-02)

Discipline Specific Elective (DSE-2B Chemistry) is a course for VI semester offered under the main Disciple/Subject of study or a Project/Dissertation, which should be compulsorily studied by a student as a core requirement of the programme

UNIT I: Inorganic Chemistry

Metallurgy:

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent.

Pyrometallurgy: Extraction of Nickel from sulphide ore – general metallurgy followed by Mond's process (purification), manganese from oxide ores – reduction by the Aluminothermite process – refining by electrolytic process.

Hydrometallurgy: Extraction of gold from native ore by cyanide process and refining by quartation process.

Electrometallurgy: Extraction of lithium by fusion method followed by electrolysis of lithium chloride.

Powder metallurgy: Importance, and applications, production of tungsten powder. Principles of electroplating. **[11 Hours]**

Alloys:

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization,desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

Production of ferro alloys; ferro chrome, ferro manganese. **[5 Hours]**

Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry. Essential and trace elements in biological . process. Role of metal ions present in biological systems with special reference to Na^+, K^+ and

Ca^{2+}, Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} ions in blood clotting. Enzymatic role of iron in haemoglobin and myoglobin, Mg in chlorophyll and cobalt in vitamin-B12. stabilization of protein structures and structural role (bones). Biological functions and toxicity of Cr, Mn, Co, Ni and I, Hg, Mo and Se.

[5 Hours]

UNIT II : Organic Chemistry

Special techniques in organic synthesis:

a) Polymer supported reagents – introduction, properties of polymer support-advantages of polymer support reagents, choice of polymers, types and applications.
b) Phase transfer catalysis – introduction, definition, types, preparation, mechanism and advantages.
c) Microwave induced organic synthesis – introduction, reaction vessel, reaction medium, advantages, limitations, precaution and applications.
d) Sonochemistry – use of ultra sound in organic synthesis, introduction, instrumentation, physical aspects, types and applications. **[7 Hours]**

Natural Pigments: Introduction to anthocyanines, structural formulae and their importance of anthocyanins, β-carotene and haemoglobin. **[2 Hours]**

Diazonium Compounds: preparation, mechanism of preparation and synthetic applications of benzene diazonium chloride. Conversion to phenol, halobenzene, phenyl hydrazine and coupling reaction. **[2 Hours]**

Hydroxy acids: Synthesis of lactic, citric and tartaric acids. One method each and their importance. Effect of heat on α, β, γ-hydroxy acids. **[3 Hours]**

Nucleic acids: Types, components, formation of nucleic acids, structure of DNA and RNA, importance of these in biological system. [**2 Hours]**

Identification of organic compounds by spectroscopic technique:

UV-visible spectroscopy: Introduction, chromophores and auxochrome, blue shift and red shift, graphical representation of spectra of 1,3-butadiene, benzene and lycopene. Influence of conjugation on UV absorption-comparison of UV spectra of acetone and methylvinyl ketone

IR-Spectroscopy: Introduction, stretching frequency of –OH (free and H-bonded), alkyl –C-H, C=C, C=C, C-C, C=O and C-O groups (by taking suitable examples). Graphical representation of IR spectra of benzoic acid and methyl benzoate

NMR Spectroscopy: Basic principles of proton magnetic resonance , nuclear magnetic spin quantum number I, influence of the magnetic field on the spin of nuclei, spin population, saturation using radio frequency, nuclear magnetic resonance-chemical shift (δ value), uses of TMS reference, nuclear shielding effects, equivalent and non-equivalent protons, spin-spin splitting and coupling.

Applications of NMR spectroscopy to simple organic molecules (like ethyl alcohol, ethane, propane, ethylene, methylamine, aniline, benzene, toluene, acetone, acetophenone, methyl cyanide and other simple molecules. **[6 Hours]**

UNIT III: Physical Chemistry

Electrochemistry

Electrolytic and electrochemical cells, electrode reaction of Daniel cell, single electrode potential, sign of electrode potential-convention (reduction potential to be adopted), convention of representing a cell, EMF and standard EMF of a cell, cell reaction, reversible and irreversible cells, Nernst equation (to be derived) and calculation of electrode potential, standard hydrogen gas electrode, reference electrodes-calomel and Ag-AgCl electrode-construction and working, electrochemical series and its significance, equilibrium constant and free energy of cell reaction, spontaneity of a cell reaction, concentration cells.

EMF of concentration cells: Definition with explanation – with transference and without transference, concentration cells – with examples. Liquid junction potential and salt bridge. (Numerical problems on Nernst equation and EMF calculations).

Application of EMF measurements: (a) Determination of pH of a solution using quinhydrone electrode and glass electrode (using dip type Calomel electrode) – Explanation with principle and procedure. (b) Potentiometric titration – principle, location of end points in - (1) Neutralization reactions [NaOH Vs HCl] (2) Oxidation-reduction reactions [$K_2Cr_2O_7$ Vs FAS] (3) Precipitation reaction [KCl Vs $AgNO_3$] and (4) Complexometric reactions ($ZnSO_4$ Vs $K_3[Fe(CN)_6]$) **[9 Hours]**

Phase equilibria: Gibb's phase rule – definition of the terms with examples, application to one component system (water and sulphur system), reduced phase rule – statement, reduced systems, two component system – simple eutectic type KI-water system, freezing mixtures, Pb-Ag system (desilverization of argentiferrous lead) **[5 Hours]**

Adsorption: Adsorption of gases on solids – factors which influence. Adsorption isotherms (definition) –Freundlich's and Langmuir's adsorption isotherms and BET equation (to be derived). Applications of adsorption. **[3 Hours]**

Kinetics of fast reactions and techniques:

Introduction, examples of fast reactions. Techniques – principle and procedure involved in - stopped flow method, flash photolysis, temperature jump method and pressure jump method.

[4 Hours]

VI Semester Practicals

CHEMISTRY-DSE-2B LAB

Practical duration: 1 practical per week of 4 hrs

64 Hours (Credits: 02)

Determination of solubility of sparingly soluble salt (like $BaSO_4$) by conductometric method.

1. Determination of K_a (dissociation constant of a weak acid) using digital conductometer.
2. Determination of rate constant of saponification of ethyl acetate by conductivity measurements.
3. Conductometric titration of strong acid x strong base and weak acid x strong base.
4. Determination of percentage composition of a given mixture containing two miscible liquids by Abbe's refractometer.
5. Potentiometric titration of ferrous ammonium sulphate against potassium dichromate.
6. pH titration of strong acid against strong base (by observing change in pH).
7. Potentiometric titration of mixture of HCl and CH_3COOH using NaOH solution.
8. Colorimeteric estimation of Fe^{3+} ion using ammonium thiocyanate as complexing agent.
9. Colorimeteric estimation of Cu^{2+} ion using NH_4OH as complexing agent.
10. Colorimeteric study of kinetics of oxidation of indigocarmine by chloramine-T.
11. Determination of pH of aerated drinks, fruit juices, shampoos and soaps.

Chromatography:

12. Paper chromatographic separation of Fe^{3+} and Ni^{2+} ions.
13. Paper chromatographic separation of Na^+ and K^+ ions.

Solvent extraction:

14. Separation of a mixture of Fe^{2+} and Ni^{2+} by complexation with DMG.

V SEMESTER

CHEMISTRY (SEC-1)

BASIC ANALYTICAL CHEMISTRY

CLASS DURATION – THEORY: 02 HOURS/WEEK

Theory: 32 Hours (Credits-02)

Skill Enhancement Course (Chemistry SEC-1) is a course for V semester course which may be chosen from a pool of the courses.

SEC:1 BASIC ANALYTICAL CHEMISTRY

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators.

a. Determination of pH of soil samples.

b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration. **11 hours**

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample.

b. 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.

a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.

b. Analysis of preservatives and colouring matter. **10 hours**

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}).

b. To compare paint samples by TLC method.

Ion-exchange: Column, ion-exchange chromatography etc.

Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible). **11 hours**

Reference Books:

- Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
- Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- Skoog, D.A.; West, D.M. & Holler, F.J. *Fundamentals of Analytical Chemistry 6th Ed.*, Saunders College Publishing, Fort Worth (1992).
- Harris, D. C. *Quantitative Chemical Analysis*, W. H. Freeman.
- Dean, J. A. *Analytical Chemistry Notebook*, McGraw Hill.
- Day, R. A. & Underwood, A. L. *Quantitative Analysis*, Prentice Hall of India.
- Freifelder, D. *Physical Biochemistry 2nd Ed.,* W.H. Freeman and Co., N.Y. USA (1982).
- Cooper, T.G. *The Tools of Biochemistry*, John Wiley and Sons, N.Y. USA. 16 (1977).
- Vogel, A. I. *Vogel's Qualitative Inorganic Analysis 7th Ed.,* Prentice Hall.
- Vogel, A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.*, Prentice Hall.
- Robinson, J.W. *Undergraduate Instrumental Analysis 5th Ed.*, Marcel Dekker, Inc., New York (1995).

V SEMESTER

CHEMISTRY (SEC-2)

FUEL CHEMISTRY

CLASS DURATION – THEORY: 02 HOURS/WEEK

Theory: 32 Hours (Credits-02)

Skill Enhancement Course (Chemistry SEC-2) is a course for V semester course which may be chosen from a pool of the courses.

SEC:2 FUEL CHEMISTRY

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

11 hours

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications.

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels.

Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene. **16 hours**

Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants.

Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

05 hours

Reference Books:

- Stocchi, E. *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK (1990).
- Jain, P.C. & Jain, M. *Engineering Chemistry* Dhanpat Rai & Sons, Delhi.
- Sharma, B.K. & Gaur, H. *Industrial Chemistry,* Goel Publishing House, Meerut(1996).

VI SEMESTER

CHEMISTRY (SEC-3)

POLYMER CHEMISTRY

CLASS DURATION – THEORY: 02 HOURS/WEEK

Theory: 32 Hours (Credits-02)

Skill Enhancement Course (Chemistry SEC-3) is a course for VI semester course which may be chosen from a pool of the courses.

SEC:3 POLYMER CHEMISTRY

Kinetics of Polymerization:

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques. **05 hours**

Crystallization and crystallinity:

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point. **05 hours**

Polymer Solution – Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures. **10 hours**

Properties of Polymers (Physical, thermal, Flow & Mechanical Properties).

Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes,

Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly (p-phenylene sulphide polypyrrole, polythiophene)]. **12 hours**

Reference Books:

- Seymour, R.B. & Carraher, C.E. *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc. New York, 1981.
- Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.
- Billmeyer, F.W. *Textbook of Polymer Science,* 2nd Ed. Wiley Interscience, 1971.
- Ghosh, P. *Polymer Science & Technology,* Tata McGraw-Hill Education, 1991.
- Lenz, R.W. *Organic Chemistry of Synthetic High Polymers.* Interscience Publishers, New York, 1967.

VI SEMESTER

CHEMISTRY (SEC-4)

CHEMICAL TECHNOLOGY, PESTICIDE CHEMISTRY & SOCIETY

CLASS DURATION – THEORY: 02 HOURS/WEEK

Theory: 32 Hours (Credits-02)

Skill Enhancement Course (Chemistry SEC-4) is a course for VI semester course which may be chosen from a pool of the courses.

CHEMICAL TECHNOLOGY, PESTICIDE CHEMISTRY & SOCIETY

Chemical Technology

Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology. **11 hours**

Pesticide Chemistry

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor). **10 hours**

Society

Exploration of societal and technological issues from a chemical perspective. Chemical and scientific literacy as a means to better understand topics like air and water (and the trace materials found in them that are referred to as pollutants); energy from natural sources (i.e. solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids, and molecular reactivity and interconversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs. **11 hours**

References:

- Reference Book: Cremlyn, R. Pesticides. Preparation and Modes of Action, John Wiley & Sons, New York, 1978.
- Harris, D. C. *Quantitative Chemical Analysis*, W. H. Freeman.
- Dean, J. A. *Analytical Chemistry Notebook*, McGraw Hill.
- Day, R. A. & Underwood, A. L. *Quantitative Analysis*, Prentice Hall of India.
- Freifelder, D. *Physical Biochemistry 2nd Ed.,* W.H. Freeman and Co., N.Y. USA (1982).
- Cooper, T.G. *The Tools of Biochemistry*, John Wiley and Sons, N.Y. USA. 16 (1977).
- John W. Hill, Terry W. McCreary & Doris K. Kolb, Chemistry for changing times 13th Ed.

Reference Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of structure and Reactivity*, Pearson Education India, 2006.
- Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
- Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
- Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
- Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
- Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
- Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York(1985).
- Nelson, D. L. & Cox, M. M. Lehninger¡¦s *Principles of Biochemistry*, 7th Ed., W. H.Freeman.
- Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, W.H. Freeman, 2002.
- Shriver, D.F. & Atkins, P.W. *Inorganic Chemistry*, Oxford University Press.
- Wulfsberg, G. *Inorganic Chemistry*, Viva Books Pvt. Ltd.
- Rodgers, G.E. *Inorganic & Solid State Chemistry*, Cengage Learning India Ltd.,2008.
- Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012)
- Adam, D.M. *Inorganic Solids: An introduction to concepts in solid-state structural chemistry*. John Wiley & Sons, 1974.

- Poole, C.P. & Owens, F.J. *Introduction to Nanotechnology* John Wiley & Sons, 2003.
- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- J. A. Kent: *Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.*
- *S. S. Dara: A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
- K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
- S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi
- S.E. Manahan, *Environmental Chemistry*, CRC Press (2005).
- G.T. Miller, *Environmental Science* 11th edition. Brooks/ Cole (2006).
- Mishra, *Environmental Studies*. Selective and Scientific Books, New Delhi (2005).
- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
- P. C. Jain & M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
- R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
- K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut Reference books:
- Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
- P.W. Atkins: *Physical Chemistry.*
- G.W. Castellan: *Physical Chemistry.*
- Brian Smith: *Infrared Spectral Interpretations: A Systematic Approach.*
- W.J. Moore: *Physical Chemistry.*
- Banwell, C. N. & McCash, E. M. *Fundamentals of Molecular Spectroscopy* 4th Ed. Tata McGraw-Hill: New Delhi (2006).
- Chandra, A. K. *Introductory Quantum Chemistry* Tata McGraw-Hill (2001).
- House, J. E. *Fundamentals of Quantum Chemistry* 2nd Ed. Elsevier: USA (2004).
- Lowe, J. P. & Peterson, K. *Quantum Chemistry*, Academic Press (2005).

- Kakkar, R. *Atomic & Molecular Spectroscopy*: *Concepts & Applications*, Cambridge University Press (2015).
- K J Laidler. *Chemical kinetics.*
- J Rajaram and J C Kuriacose. *Kinetics and mechanism of chemical transformation*.
- Frost and Pearson. Chemical kinetics.
- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R.
- Chand & Co.: New Delhi (2011).
- Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry*, Universities Press.
- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.;* McGraw-Hill: New York (2003).
- Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).
- A.I. Vogel: *Qualitative Inorganic Analysis*, Prentice Hall, 7th Edn.
- A.I. Vogel: *Quantitative Chemical Analysis*, Prentice Hall, 6th Edn.
- P. L. Soni. *A Text book of Inorganic Chemistry*, Sultan Chand & Sons.
- B. R. Puri & L. Sharma. *A Text book of Inorganic Chemistry*, Shobhanlal Nagin Chand Co.
- Puri, Sharma & Kalia. *Principles of Inorganic Chemistry*, Shobhanlal Nagin Chand Co.
- Gurudeep Raj. *A Text book of Inorganic Chemistry*.
- Madan, Malik, Tuli. *Selected Topics in Inorganic Chemistry*, S. Chand & Company.
- A. K. De. *A Text book of Inorganic Chemistry*, New Age International.
- O. P. Agarwal. *Comprehensive Inorganic Chemistry.*
- Kapoor & Chopra. *Inorganic Chemistry.*
- B. K. Sharma. *Engineering Chemistry.*
- B. K. Sharma. *Industrial Chemistry.*
- Jain and Jain. *Engineering Chemistry*.

- R. Gopalan. *Elements of Nuclear Chemistry.*
- B. N. Chakarbathy. *Industrial Chemistry.* Oxford & IBH Publishers.
- Gurdeep R. Chatwal & Sham Anand. *Instrumental methods of Chemical analysis,* Himalaya Publishing House.
- C. R. Chatwal. *Inorganic Polymers,* Himalaya Publishing House.
- Manku. *Theoretical Principles of Inorganic Chemistry,* Tata McGraw Hills.
- Gurudeep Raj. *Advanced Practical Inorganic Chemistry,* Goel Publishing House.
- C. N. R. Rao. *University Chemistry,* Mac Millan Company.
- Robinson & Heslop. A Text book of Inorganic Chemistry, New Age Publications.
- Willard, Meritind & Dean, *Analytical Chemistry,* New Age Publications.
- Chattopadhyay. *Introduction to nanoscience & nanotechnology.*
- Dr. Shuthosh Sharma & Dr. Bellari. *Advances in nanoscience & nanotechnology.*
- M. K. Jain. *A Text book of Organic Chemistry,* S. Chand & Company
- Bhal & Bhal. *A Text book of Organic Chemistry,* Chand & Company
- P. L. Soni. *A Text book of Organic Chemistry,* S. Chand & Company
- Raj K. Bansal. *Laboratory Manual of Organic Chemistry,* New Age Publications
- Jayaraman.S. *Laboratory Manual of Organic Chemistry,* Chand & Company.
- Aggarwal. *Chemistry of Natural products,* Goel Publishing House Meerut.
- K. K. Sharma. *Organic Chemistry,* Shobhanlal & Nagan Company.
- Puri & Sharma. *Organic Chemistry,* Shobhanlal & Nagan Company.
- Ashuthosh Kar. *Medicinal Chemistry,* Tata Mcgraw Hill Publications.
- Handrickson. *Organic Chemistry,* Tata Mcgraw Hill Publications
- V. K. Ahluwalia & Renu Aggarwal. *Organic Synthesis special techniques,* Narosa publishing House.
- Eliel. *Stereo Chemistry,* John Wiley Eastern Publications
- Raj K. Bansal. *Heterocyclic Chemistry,* Tata Mcgraw Hill Publications
- V. Kumar. *An introduction Green Chemistry.*
- R. P. Verma. *Physical Chemistry,* Pradeep Publication
- S. K. Jain. *Kinetics of Chemical Reactions,* Vishal publications, Jalandhar, New Delhi.
- M. Kundan & S. K. Jain. *Physical Chemistry.* S. Chand & Company

- K. K. Sharma & C. K. Sharma. *Text book of Physical Chemistry*, Vani Educational Books.
- Upadhyaya & Upadhyaya. *Biophysical Chemistry,* Himalaya Publishing Homes.
- Puri, Sharma & Pathania. *Principles of physical chemistry.*
- B. S. Bahl, Arun Bahl & G. D. Tuli. *Essentials of physical chemistry.*
- V. R. Gowriker. N. V. Vishwanathan & J. Sreedhar, *Polymer Science.*
- A.K. Chandra. *Quantum Chemistry (*2nd edition).
- R.K. Prasad. *Quantum Chemistry.*
- R. L. Madan & G. D. Tuli. *Physical Chemistry*, S. Chand & Company.
- Gurudeep Raj. *Text book of advanced Physical Chemistry,* Goel Prakashan. Meerut.
- Jain & Jain. *Engineering Chemistry*, Dhanpal & Sons, New Delhi.
- W. Bansal. *Text book of Photochemistry*, S. Chand & Company
- Pathania & Sharma. *Physical Chemistry,* Vishal Publications Jalandhar & Delhi.

SCHEME OF VALUATION IN CHEMISTRY FOR THE

PRACTICAL EXAMINATION 2018-19

I SEMESTER

CHEMISTRY DSC-2A

C1: 5 marks,C2: 5 marks and C3: 40marks

Practical Duration: 3Hrs **Practical proper Marks: 40**

Note: Duly certified practical record shall be submitted at the time of practical examination.

PART- A:

C1 Practical Test: 05 marks

C2: RECORD: 03 MARKS and VIVA: 02 MARKS

C3: Final Practical Examination

VOLUMETRIC ESTIMATIONS-

PART- B : Marks: 40 marks

Procedure writing : **06 Marks**

b) Preparation of standard solution and calculation of normality **Marks: 06+02 = 08**

Titre values of standardization + Estimation **Marks: 10+10= 20**

Calculation **Marks: 2+2 = 04**

SCHEME OF VALUATION IN CHEMISTRY FOR THE

PRACTICAL EXAMINATION 2018-19

II SEMESTER

CHEMISTRY DSC-2B

C1: 5 marks,C2: 5 marks and C3: 40marks

Practical Duration: 3Hrs **Practical Proper Marks: 40**

Note: Duly certified practical record shall be submitted at the time of practical examination.

PART- A:

C1 Practical Test: 05 marks

C2: RECORD: 03 MARKS and VIVA: 02 MARKS

C3: Final Practical Examination

PART- B : Marks: 40 marks

a) Analysis of organic compounds: 32 Marks

b) Preparation of organic compounds: 08 Marks

SCHEME OF VALUATION IN CHEMISTRY FOR THE

PRACTICAL EXAMINATION 2018-19

III SEMESTER

CHEMISTRY DSC-2C

C1: 5 marks,C2: 5 marks and C3: 40marks

Practical Duration: 3Hrs **Practical proper Marks: 40**

Note: Duly certified practical record shall be submitted at the time of practical examination.

PART- A:

C1 Practical Test: 05 marks

C2: RECORD: 03 MARKS and VIVA: 02 MARKS

C3: Final Practical Examination

PART- B : Marks: 40 marks

a) Analysis of Inorganic salt mixture: 32 Marks

b) Preparation of Inorganic Complex: 08Marks

SCHEME OF VALUATION IN CHEMISTRY FOR THE

PRACTICAL EXAMINATION 2018-19

IV SEMESTER

CHEMISTRY DSC-2D

C1: 5 marks,C2: 5 marks and C3: 40marks

Practical Duration: 3Hrs **Practical proper Marks: 40**

Note: Duly certified practical record shall be submitted at the time of practical examination.

PART- A:

C1 Practical Test: 05 marks

C2: RECORD: 03 MARKS and VIVA: 02 MARKS

C3: Final Practical Examination

PART- B : Marks: 40 marks

a) Physical Chemistry Experiments: Calculation, Graph, Experiment, Result: 32 Marks

b) Procedure writing for Organic Estimation Experiment: 08 Marks

SCHEME OF VALUATION IN CHEMISTRY FOR THE

PRACTICAL EXAMINATION 2018-19

V SEMESTER

CHEMISTRY DSE-2A

C1: 5 marks, C2: 5 marks and C3:40marks

Practical Duration: 3Hrs **Practical proper Marks: 40**

Note: Duly certified practical record shall be submitted at the time of practical examination.

PART- A:

C1 Practical Test: 05 marks

C2: RECORD: 03 MARKS and VIVA: 02 MARKS

C3: Final Practical Examination

PART- B : Marks: 40 marks

a) Gravimetric Estimation: 32 Marks

b) Procedure writing for Ore/Alloy Estimation: 08 Marks

SCHEME OF VALUATION IN CHEMISTRY FOR THE

PRACTICAL EXAMINATION 2018-19

VI SEMESTER

CHEMISTRY DSE-2B

C1: 5 marks,C2: 5 marks and C3: 40marks

Practical Duration: 3Hrs **Practical proper Marks: 40**

Note: Duly certified practical record shall be submitted at the time of practical examination.

PART- A:

C1 Practical Test: 05 marks

C2: RECORD: 03 MARKS and VIVA: 02 MARKS

C3: Final Practical Examination

PART- B : Marks: 40 marks

a) Physical Chemistry Instrumental Experiments:

- Calculation, Graph, Experiment, Result: 32 Marks

b) Procedure writing for Chromatography and Solvent Extraction: 08 Marks

Chairman BOS in Chemistry

Learning outcomes of Chemistry –I (first semester) – DSC 2A:

Students will gain an understand of:

a) the fundamental properties and basic model of atoms, simple quantum mechanical treatments of atoms and shapes of the orbitals which are important to understand the reaction mechanism and formation of molecule.

b) the arrangement of elements in the periodic table in different blocks and the variation of different properties in the periodic table and the factors responsible for the variation.

c) basic concept of organic chemistry identify basic types of chemical reactions in organic chemistry.

d) types of indicators used in different reactions and the theory involved in it,miscibility of different liquid mixtures at respective temperatures,principles of fractional distillation and applications, distribution laws and applications and the students will be able to work out numerical problems.

e) Use of the concept of the mole in quantitative chemical calculations, understand stoichiometric relationshipinvolved in reactions.

f) Use of different methods of purification of compound and naming of different organic compounds in IUPAC system. Role of organic compounds in daily life.

Learning outcomes of practical chemistry-I (first semester) – DSC 2A lab :

a) Students will be able to design and carry out scientific experiments as well as accurately record and analyse the result of such experiments

b) Students will be skilled in analytical resoning as applied to scientific problems.

Learning outcomes of chemistry-II (second semester)- DSC 2B :

Students will gain an understanding of:

a) the bonding fundamentals of ionic and covalent compounds, including bond energies using MO diagrams.

b) predicting geometries of simple molecules with the use of theory.

c) stability of conformational isomers of cycloalkanes, naming of different aromatic hydrocarbons different naming reactions aromatic derivatives, and effect of nature of

alkyl groups, leaving groups, nucleophiles and solvents on nucleophilic substitution reaction.

d) how reaction rates are measured and represented in rates laws and application of chemical kinetics.
e) ionic equilibria; theory of strong electrolytes, degree of hydrolysis , effect of temperature and dilution on degree of hydrolysis.
f) preparation and synthetic applications of organic reagents, types and classification of polymers, solving numerical problems on determination of molar mass of polymer.
g) Comparision of organic and inorganic precipitates, how soaps and detergents act on dirt in cleaning process.

Learning out comes of Practical chemistry – II (second semester) – DSC 2B lab:

a) Students will be able to identify the organic compound systematical experimental methods.
b) Laboratory skill and ability of thinking to design new compounds will be enhanced.

Learning outcomes of chemistry-III(third semester)- DSC 2C :

Students will gain an understanding of:

a) Position of the transition elements in the periodic table, chemistry of inner transition elements, chemistry of organometallic compounds and structures of few rare organometallic compounds.

b) Types of alcohols and their preparations and uses, classification of phenols, why phenol is corrosive and few naming reaction associated with phenols, chemistry of ethers, epoxides, crown ethers and carbonyl compounds and the mechanism involved with few important reactions.

c) Need for the thermodynamics of second law, significance of entropy, calculating bond energy, bond dissociation energy and resonance energy using thermodynamic data.

d) X-ray crystallographycal studies and numerical problems in solving the crystals, different cromatographycal technics and its use in separation, knowledge of different energy sources, fundamental uniqueness of the chemical and physical properties of nanomaterials and their potential impact in science, methods of nanomaterials preparation, aminoacids which are the building blocks of proteins and one can think of constructing new peptide bonds at nano level.

Learning outcomes of practical chemistry-III (third semester)- DSC 2C lab:

a) Students will be able to identify the inorganic salts in the given mixture.

b) The laboratory skill of preparing inorganic compounds in a simple way is enhanced.

Learning outcomes of practical chemistry-IV (fourth semester)- DSC 2D:

Students will gain an understanding of :

a) Bonding in complexes and types, Concept of VBT and CFT in understanding the geometry of complexes, application of complexes in treating cancer and heavy metal poisoning, Ligan field theory which is the evidence for cbonding in complexes.

b) Sterochemistry of organic compounds, types of isomerism in organic chemistry, classification of carbohydrates, structutral elucidation of carbohydrates like glucose fructose.

c) Partial structure of polysaccharides.

d) Elemental quantum mechanics, concept of black body radiation, to determine equivalent conductance at infinite dilution for weak electrolyte, transport number, application of conductance measurements and conductometric titrations.

e) Classification of acids and bases as Hard and Soft, gravimetric estimations and its advantages.

f) Structure and synthesis of dyes.

g) Concept of viscosity measurements, intermolecular forces, size and weight of the molecules, surface tension and parachor.

Learning outcomes of practical chemistry-IV (fourth semester)- DSC 2D lab:

a) Students will be to measure physical properties like viscosity, density, surface tension of different liquids, speed of the reaction at regular intervals in laboratory condition.

b) students will be able to estimate Organic compouns, deterimation of few physical properties in organic compound, isolate caffine in tea leaves.

Learning outcomes of chemistry-V (fifh semester)- DSE 2A:

Students will gain an understanding of :

a) indusrial applications of inorganic chemistry in manufacturing of glass, ceramics, cements, study of paints in dept.

b) synthetic method of preparing terpenes, Synthesis of different class of heterocyles which play a very important role in pharmaceutical chemistry.

c) structure and classification of alkaloids, uric acids, vitamins, harmones, different chemotherapeutic agents and their synthesis.

d) photochemistry and radiation chemistry, new spectroscopic methods like IR, Raman Spectroscopy, molecular spectroscopy,electronic spectra.

Learning outcomes of practical chemistry-V (fifh semester)- DSE 2A lab:

a) Students will understand gravimetric method of estimating the compounds, estimation of a metal in the ore and simple method of estimating the metal in alloy.

Learning outcomes of chemistry-VI (sixth semester)- DSE 2B:

Students will gain an understanding of :

a) types of metallurgy and metallurgical applications of inorganic chemistry in manufacturing of different metals and their purifaction.

b) production of ferro alloys.

c) structure and role of metal ion in biological system with refrence to Na^+, K^+ and Ca^{2+}, Mg^{2+} ions , enzymatic roleof metals in heamoglobin and myoglobin. Natyral pigments, hydroxyl

d) synthesis of organic polymers by utilizing special technics, classification and synthesis of nucleic acids, hydroxyl acids, diazonium compounds.

e) Spectroscopic method of identification of compounds ; IR, UV visible and NMR spectroscopy in depth.

f) electrochemistry ; cell construction, applications of EMF measurements, concept of phase equilibria, adsorption and kinetics of fast reactions and principles of techniques stopped flow method, flash photolysis, temperature jump method and pressure jump method.

Learning outcomes of practical chemistry-VI (sixth semester)- DSE 2B lab:

a) Students will understand different instrumental method of determining phycal constants, titration using instruments like potentiometer, conductometer, colorimetric estimation of metal ion.

b) paperchromatographic method of separating ions and solvent extraction.

Learning outcomes of chemistry-V (fifth semester)- SEC 1:

Students will gain an understanding of :

a) analytical chemistry and its interdisciplinary nature, basic analytical techniques in soil analysis, water analysis, food products.

b) principle and applications of thin layer chromatography and column chromatography by ion exchange method.

Learning outcomes of chemistry-V (fifth semester)- SEC 2:

Students will gain an understanding of :

a) detail study of renwable , non renewable sources which is very important in recent years.

b) principle and applications of petroleum and petroleum products.