JSS COLLEGE FOR WOMEN (Autonomous)
Saraswathipuram, Mysuru- 570 009

B.Sc. (Honors) Degree Programme in Chemistry

NATIONAL EDUCATION POLICY (NEP) – 2020

CHOICE BASED CREDIT SYSTEM (CBCS) WITH MULTIPLE ENTRY AND EXIT OPTIONS

2021-22

Program Outcomes:

By the end of the program the students will be able to:

(Refer to literature on outcome-based education (OBE) for details on Program Outcomes)

1. **PO. 1:** To create enthusiasm among students for chemistry and its application in various fields oflife.
2. **PO. 2:** To provide students with broad and balanced knowledge and understanding of key concepts inchemistry
3. **PO. 3:** To develop in students a range of practical skills so that they can understand and assess risks and work safely measures to be followed in thelaboratory.
4. **PO. 4:** To develop in students the ability to apply standard methodology to the solution of problems inchemistry
5. **PO. 5:** To provide students with knowledge and skill towards employment or higher education in Analytical chemistry or multi-disciplinary areas involvingchemistry.
6. **PO.6:**To provide students with the ability to plan and carryout experiments independently and assess the significance of outcomes and to cater to the demands of chemical Industries of well-trainedgraduates
7. **PO. 7:** To develop in students the ability to adapt and apply methodology to the solution of unfamiliar types ofproblems.
8. **PO. 8:** To instill critical awareness of advances at the forefront of chemical sciences, to prepare students effectively for professional employment or research degrees inchemical sciences and to develop an independent and responsible workethics.

Details of the B.Sc (Honors) degree programme in Chemistry

Semester	Course Type DSC								DSE				OE		
	THEORY	L	T	P	PRACTICALS	L	T	P		L	T	P	L	T	p
I	**A1**	4	0	0	**P-1**	0	0	2					3	0	0
II	**A2**	4	0	0	**P-2**	0	0	2					3	0	0
III	**A3**	4	0	0	**P-3**	0	0	2					3	0	0
IV	**A4**	4	0	0	**P-4**	0	0	2					3	0	0
V	**A5** **A6**	3 3	0 0	0 2	**P-5** **P-6**	0 0	0 0	2 2	A1	3	0	0			
VI	**A7** **A8**	3 3	0 0	0 0	**P-7** **P-8**	0 0	0 0	2 2	A2	3	0	0			
VII	**A9** **A10** **A11**	3 3 4	0 0 0	0 0 0	**P9** **P10**	0 0	0 0	2 2	A3 RESEARCH METHADOLOGY	3 3	0 0	0 0			
VIII	**A12** **A13** **A14**	4 4 3	0 0 0	0 0 0					A4 PROJECT	3 0	0 0	0 6			
TOTAL CREDITS	69								21						

DSC: DISCIPLINE SPECIFIC COURSE

DSE: DISCIPLINE SPECIFIC ELECTIVE

OE: OPEN ELECTIVE.

L : T : P = Lecture : Tutorial :Practical

GENERAL REQUIREMENTS AND OTHER INFORMATIONS.

Scheme of Instructions

1. **Title and Commencement**: As per the university guidelines (12 Ref.letterUA2/379/2016-17).
2. Undergraduate programme offered with multiple entry and exit options

   Faculty of Science–
   Certificate – 2 semesters
   Diploma– 4semesters
   Bachelor of Science (B.Sc. 6 Semesters)
   Bachelor of Science. Honors (B.Sc. Hons, 8 Semesters)

Semester and Programme Structure:

The credit pattern for the course is L:P

3. **Subject Combinations:** As per the university guidelines (Ref. letterUA2/379/2016-17).
4. **Eligibility for Admission.**

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

5. **Medium of Instruction:** The medium of instruction shall be English/Kannada.
6. **Scheme of the Program:** As per the university guidelines (Ref.letterUA2/379/2016-17)**.**
7. **Course Registration**: As per the university guidelines (9.1 to 9.6 Ref.letterUA2/379/2016-17)**.**
8. **Attendance:** As per the university guidelines (10.1 and 10.2 Ref.letterUA2/379/2016-17)
9. **Valuation:**Aspertheuniversityguidelines(Ref.letterAC2(S)/151/2021-22,dated18/08/2021
10. Ifthestudenthaspassedinthepracticalexambysecuringprescribedmarksneednotreappear for the practical exam if he/she has failed in the theory exam.
11. **Passing Criteria**

    A student is considered to have passed the course, only on securing a minimum of 40% from internal assessment and end examination marks put together.

    A student can take end exam irrespective of the marks scored in internal assessment of a particular course

    In case a student secures less than 30% in end exam or absent for end examination, the student is said to have not completed the course. The student shall complete the course by reappearing only the end examination conducted by the university.

    Makeup examination: As per the university guidelines (16. Ref. letterUA2/379/2016-17).

Percentage and Grading: As per the university guidelines (17 Ref.letter UA2/379/2016-17)**. 18 to 22.** As per the university guidelines (Ref. letterUA2/379/2016-17)

Scheme of Examination for DSC 1 and 2
(I and II Semester)

Credits L : P		**Theory**	**Practical**	**Maximum marks**
4 : 0	**Internal assessment**	**40** C1 = 10 + 10 = 20 C2= 10 + 10 = 20 (test and assignment)	**25** C1= 10 C2 =10 + Record 5	
0 : 2	**Summative Assessment**	**60** (C3)	**25**	
Duration of the end examination		2 hours	4 hours	
		100	**50**	**150**

Examination and Evaluation

Question paper pattern for DSC 1 and 2
(I and II Semester)

Duration: 2 hours		**Max. Marks**: 60
The question paper contains 3 parts		
Part-A	Answer any 6 out of 8 questions **(two questions from each unit)**	6 X 2 = 12
Part-B (Analytical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-C (Inorganic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-D (Organic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-E (Physical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Pattern: (3 + 3) / (4 + 2)/(2+2+2)		

Scheme of Examination for Open elective

Credits L : P	Theory	Maximum marks
3: 0	Internal assessment	**40** C1 = 10 + 10 = 20 C2= 10 + 10 = 20 (test and assignment)
	Summative assessment	**60** (C3)
Duration of the end examination		2 hours
		100

Question paper pattern for Open elective (I to IV Semester)

Duration: 2 hours		**Max. Marks**: 60
The question paper contains 2 parts		
Part-A	Answer any 6 out of 8 questions	6 X 2 = 12
Part-B	Answer any 8 out of 10 questions	8 x 6 = 48
Pattern: Pattern: (3 + 3) / (4 + 2)/(2+2+2)		

SCHEME OF VALUATION IN CHEMISTRY FOR THE PRACTICALEXAMINATIONS2021-22

I Semester

Inorganic and organic chemistry practicals P-1

Chemistry DSC-P-1(Practical–I) Max marks: 50

Practicaltest : 20 marks

Record : 05marks

FinalPracticalexamination : 25marks

Practical duration: 4Hours

Note: Duly Certified practical record shall be submitted at the practical examination (No evaluation of record)

Final Practical Examination:

Part A – Volumetric estimation (Inorganic)	13 marks
Part B – Organic preparation	12 marks

Part A- volumetric estimation

Scheme for volumetric estimation (Experiments 1,5,6) – 13 Marks

a) Preparation of Standard solution and Calculation of Normality: (1+1 marks)=02marks

b) Titre values of Standardization and estimation (3 + 5) = 8marks

ExperimentalValues:

Experimental values	Marks for standardization	Marks for estimation
±0.2 cm3	3	5
±0.3 cm3	2	4
Any other value	1	3

c) Calculation:(Normality of link solution, given solution and Wt/dm3 or 500cm3 or 250cm3 (1+1+1marks)3marks

Scheme for volumetric estimation (Experiments 2,3,4) – 13 Marks

Discrepancy	First titration	Second titration
±0.2 cm3	4	5
±0.3 cm3	3	4
Any other value	2	3

Calculation: 2 +2

Part – B – Organic preparations. – 12 Marks

Scheme for organic preparation

Preparation – 06Marks

Equation – 02 Marks

Yield – 01 Marks

Recrystallization – 02 Marks

Melting point – 01 Marks

II Semester

Analytical and physical Chemistry practicalsP-2

Chemistry DSC-P-2(Practical–II) **Max. marks:50**

Practicaltest :20marks

Record :05marks

FinalPractical examination : 25marks

Practicalduration:4Hours

Note: Duly Certified practical record shall be submitted at the practical examination

(No evaluation ofrecord)

Final Practical Examination:

Part A – Volumetric Estimation (Analytical)	13 Marks
Part B – Physical Chemistry Experiments	12 Marks

Part A –Analytical Chemistry experiments

Volumetric estimation **13 Marks**

Scheme of valuation (Experiments1,3,4,5)

a) Preparation of Standard solution and Calculation of Normality: (1+1 marks)=02marks

b) Titre values of Standardization and estimation (3 + 5) = 8 marks

Experimental Values:

Experimental values	Marks for standardization	Marks for estimation
±0.2 cm3	3	5
±0.3 cm3	2	4
Any other value	1	3

c) Calculation: (Normality of link solution, given solution and wt/dm3 or 500cm3 or 250cm3 (1+1+1marks)3marks

Scheme (Experiment 2) – 13 Marks

a) Preparation of Standard K_2Cr2O_7 solution: = 02marks

b) calculation of Normality – 2marks

c) Titre values of estimation = 6 marks

Experimental Values:

Experimental values	Marks for estimation
±0.2 cm3	5
±0.3 cm3	4
Any other value	3

d) Calculation: (Normality of given solution and wt/dm3 or 500cm3 or 250cm3 (2+1marks)3marks

Scheme (Experiment 6) – 13 Marks

a) Preparation of two solution(2+2) : = 04marks

b) estimation 1 and 2

Experimental Values:

Experimental values	Estimation 1	Estimation 2
±0.2 cm3	4	4
±0.3 cm3	3	3
Any other value	2	2

c) Calculation: (Normality of given solution and wt/dm3 or 500cm3 or 250cm3 = 1marks

Part B – Physical chemistry experiments

Distribution of marks: 12

Sl. No.	Experiment	Discrepancy between and Reportedvalue	Marks	Experiment.	Discrepancy between and Reportedvalue	Marks
1	Density	± 0.2	02	Viscosity	±0.5	06
		±.3	01		±1.0	05
		Any otherValue	01		Any otherValue	04
		Calculation	01		Calculation	01
		SI unit	01		SI unit	01
2.	Density	± 0.2	02	Surface tension	±0.5	06
		± 0.3	01		±1.0	05
		Any otherValue	01		Any otherValue	04
		Calculation	01		Calculation	01
		SI unit	01		SI unit	01
3.	Percentage composition of given mixture using Abbe'S Refractometer.	Preparation of Mixture ±5%. ±10%. Any other value Graph	03 07 06 05 02			
4	Determination of partition coefficient	(i) (ii) (iii)	4 4 4			

5	Kinetics of hydrogen peroxide	5 constant values 4 constant values Any other value Calculation Graph log V2/V1	07 06 05 02 02			
6	Percentage of NaCl Unknown(one)	preparation of mixture ± 0.2 % ± 0.3 % Any other value Graph	04 06 05 04 02			

I SEMESTER

DSC-1: Chemistry-1

CLASS DURATION – THEORY: 04 HOURS/WEEK

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

UNIT –I – Analytical chemistry

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 (R2).

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. **[14 Hours]**

UNIT-II: Inorganic Chemistry

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and $\psi 2$. Quantum numbers and their significance.

Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations-Electronic configurations of the elements (Z=1-30), effective nuclear charge, shielding/screening effect, Slater's rules. Variation of effective nuclear charge in Periodic Table. **[14 Hours]**

UNIT-III: Organic Chemistry

Classification and nomenclature of organic compounds, Hybridization, Shapes of organic molecules, Influence of hybridization on bond properties.

Nature of bonding in Organic molecules

Formation of Covalent bond, Types of chemical bonding, localized and delocalized, conjugation and cross conjugation, concept of resonance, electronic displacements: Inductive effect, Electromeric effect, Resonance and Hyper conjugation, cross conjugation explanation with examples. Concept of resonance, aromaticity, Huckel rule, anti-aromaticity explanation with examples. Strengths of Organic acid and bases: Comparative study with emphasis on factors effecting pK values. Relative strength of aliphatic and aromatic carboxylic acids-Acetic acid and chloroacetic acid, acetic acid and propionic acid, acetic acid and Benzoic acid. Steric effect- Relative stability of trans and cis-2-butene.

Mechanisms of Organic Reactions

Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bonds breaking- homolytic and heterolytic. Types of reagents-Electrophiles, nucleophiles, nucleophilicity and basicity. Types of organic reactions- substitution, addition, elimination, rearrangement and pericyclic reactions, explanation with examples.

Chemistry of Aliphatic hydrocarbons, Carbon-Carbon Sigma bonds

Chemistry of alkanes: Formation of alkanes, Wurtz reaction, Wurtz-Fittig reaction, Free radical substitution, Halogenation- relative reactivity and selectivity

Carbon-carbon pi bonds

Formation of alkenes and alkynes by elimination reaction. Mechanism of E1, E2, E1cb reaction. Saytzeff and Hofmann eliminations. Addition of HBr to propene, Free radical addition of HBr to propene. Addition of halogens to alkenes-carbocation and halonium ion mechanism. Stereospecificity of halogen addition. Ozonolysis mechanism - ozonolysis of propene. Addition of hydrogen halides to alkenes, mechanism, regioselectivity and relative rates of addition. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes, explanation with examples, 1,2 and 1,4- addition reactions in conjugated dienes. Diels-Alder reaction, Allylic and benzylic bromination and mechanism in propene, 1-butene, 1-toluene and ethylbenzene.

[14 hours]

UNIT-IV: Physical Chemistry

Gaseous State

Elementary aspects of kinetic theory of gases, Ideal and real gases. Boyle temperature (derivation not required), Molecular velocity, collision frequency, collision diameter, Collision cross section, collision number and mean free path and coefficient of viscosity, calculation of σ and η, variation of viscosity with temperature and pressure.

Maxwell's Boltzmann distribution law of molecular velocities (Most probable, average and root mean square velocities). Relation between RMS, average and most probable velocity and average kinetic energies. (Mathematical derivation not required), law of equipartition of energy.

Behaviour of real gases: Deviation from ideal gas behaviour. Compressibility factor (Z) and its variation with pressure for different gases. Causes of deviation from ideal behaviour, vanderWaals equation of stat (No derivation) and application in explaining real gas behaviour. Critical phenomena - Andrews isotherms of CO_2, critical constants and their calculation from van der Waals equation, Continuity of states, Law of corresponding states. Numerical problems.

Liquid State

Surface Tension: Definition and its determination using stalagmometer, effect of temperature and solute on surface tension

Viscosity: Definition, Coefficient of viscosity. Determination of viscosity of a liquid using Oswald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces.

Refraction: Specific and molar refraction- definition and advantages. Determination of refractive index by Abbes Refractometer. Additive and constitutive properties.

Parachor: Definition, Atomic and structure parachor, Elucidation of structure of benzene and benzoquinone. Viscosity and molecular structure. Molar refraction and chemical constitution.Numerical Problems. **[14 Hours]**

I SemesterPracticals

CHEMISTRY-DSC 1 LAB: 04 HOURS/WEEK

Content of Practical Course 1: List of Experiments

PART-A Inorganic Chemistry

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 phenolphthaleinindicator.
2. Determination of carbonate and hydroxide present in amixture.
3. Determination of oxalic acid and sodium oxalate in a given mixture usingstandard$KMnO_4$/NaOHsolution
4. Estimation of ferrous and ferric iron in a given mixture using standard potassiumdichromate solution
5. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of hydrogen peroxide present in thesolution.
6. Preparation of standard oxalic acid solution and standardization of potassiumpermanganate solution. Estimation of ferrous ammonium sulphate present in thesolution.

PART-B Organic Chemistry

1. Preparation of acetanilide from aniline using Zn/acetic acid (Greenmethod).
2. Synthesis of p-nitro acetanilide from acetanilide using nitratingmixture.
3. Bromination ofacetanilide
4. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (Conventionalmethod)
5. Synthesis of diazoaminobenzene from aniline (conventionalmethod).
6. Preparation of dibenzalacetone (Greenmethod).

LEARNING OUTCOMES / COURSE OUTCOMES

Chemistry as Discipline Specific Course (DSC)

B.Sc. Semester – I

CHEMISTRY:1

- The concepts of chemical analysis, accuracy, precision and statistical data treatment
- Prepare the solutions after calculating the required quantity of salts in preparing the reagents/solutions and dilution of stock solution.
- Describe the dual nature of radiation and matter; dual behavior of matter and radiation, de Broglie's equations, Heisenberg uncertainty principle and their relatedproblems.
- Quantum mechanics. Derivation of Schrodinger's wave equation. Radial and angular Orbital shapes of s, p, d and f atomic orbitals, nodal planes. Electronic configurations of theatoms.
- Pauli's exclusion principle, Hund's rule , Aufbau's principle and its limitation.
- The concepts of Organic reactions and techniques of writing the movement of electrons, bond breaking, bond forming
- The Concept of aromaticity, resonance, hyper conjugation, etc.
- Explain bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). steric effect and their applications in explaining acidic strength of carboxylic acids, basicity ofamines.
- Understand basic concept of organic reaction mechanism, types of organicreactions.
- Understand the preparation and reactions ofalkanes.
- Understand the stability and conformational analysis ofcycloalkanes.
- Understand the concept of resonance , aromaticity andantiaromaticity.
- Describe relative strength of aliphatic and aromatic carboxylicacids.
- Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of idealgases and real gases. Understand cooling effect of gas on adiabaticexpansion
- Understand the conditions required for liquefaction of gases. Realize that there is continuity in gaseous and liquidstate.
- Understand the properties of liquids in terms of intermolecularattractions.
- Understand the existence of different states of matter in terms of balance

betweenintermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabaticexpansion

- Understand the conditions required for liquefaction of gases. Realize that there is continuityin gaseous and liquidstate.
- Understand the properties of liquids in terms of intermolecularattractions.

CHEMISTRY LAB (volumetric (inorganic) and Organic preparations):P-1

After studying this course and performing the experiments set in it student will be ableto:

1. Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standardsolutions.
2. Explain the principles of acid-base, redox and iodometric titrations.
3. Work out the stoichiometric relations based on the reactions involved in the titrimetric analysis.
4. Understand the preparation of organic compounds involving addition, substitution, hydrolysis, diazotization and condensationreactions.

II SEMESTER

DSC-2: Chemistry-2

CLASS DURATION – THEORY: 04 HOURS/WEEK

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

UNIT-I: Analytical Chemistry

Titrimetric analysis: Basic principle of titrimetric analysis. Classification, Preparation and dilution of reagents/solutions. Normality, Molarity and Mole fraction. Use of N1V1= N2V2 formula, Preparation of ppm level solutions from source materials (salts), conversion factors.

Acid-basetitrimetry: 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. [**14 hours]**

Unit – II Inorganicchemistry

s, p, d and f-block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block elements:

(a) Atomic radii (van der Waals)
(b) Ionic and crystal radii.
(c) Covalent radii
(d) Ionization enthalpy, successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.
(e) Electron gain enthalpy, trends of electron gain enthalpy.
(f) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity.

Trends in the chemistry of the compounds of groups 13 to 17 (hydrides, carbides, oxides and halides) are to be discussed.

[14 hours]

Unit – III Organic chemistry

Nucleophilic substitution at saturated carbon. Mechanism of SN1 and SN2 reactions with suitable examples. Energy profile diagrams, Stereochemistry and factors effecting SN1 and SN2 reactions.

Aromatic Electrophilic substitution reactions, Mechanisms, σ and π complexes, Halogenation, Nitration,

Sulphonation, Friedel Crafts alkylation and acylation with their mechanism. Activating and deactivating groups. Orientation influence, Ortho-para ratio.
Aromatic nucleophilic substitution reaction: SNAr and Benzyne mechanism with suitable examples

[14 hours]

Unit – IV Physical Chemistry

Liquid Crystals

Explanation, classification with examples- Smetic, nematic, cholesteric, dics shaped and polymeric. Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquid crystals. Applications of liquid crystals in LCDs and thermal sensing.

Solids

Forms of solids: Unit cell and space lattice, anisotropy of crystals, size and shape of crystals,
Laws of Crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of symmetry (Symmetry elements), Crystal systems, Bravais lattice types and identification of lattice planes.
Miller indices and its calculation, X–Ray diffraction by crystals: Bragg's law and derivation of Bragg's equation, Single crystal and powder diffraction methods. Defects in crystals, glasses and liquid crystals. Numerical problems.

Distribution Law

Nernst Distribution Law - Statement and its derivation. Distribution constant, factors affecting distribution constant, validity of Distribution Law, Modification of distribution law when molecules undergo a) Association b) Dissociation. Application of Distribution Law in Solvent extraction. Derivation for simple and multiple extraction. Principles of distribution law in Parkes Process of desilverisation of lead. Numerical Problems.

[14 hours]

II Semester Practicals

CHEMISTRY-DSC 2 LAB: 04HOURS/WEEK

Content of Practical Course 2: List of Experiments

PART-A Analytical Chemistry

1. Preparation of standard sodium carbonate solution; standardization of given HCl solution and estimation of alkali present in soap/detergent
2. Preparation of standard $K_2Cr_2O_7$ solution and estimation of Iron (II) in the given solution.
3. Preparation of standard oxalic acid solution standardization of given KMnO4 solution and estimation of given oxalic acid solution.
4. Preparation of EDTA solution and estimation of hardness ($CaCO_3$) of two different samples.
5. Preparation of standard Na_2CO_3 solution , standardization of given HCl solution and estimation of alkali present in given antacid.
6. Determination of chlorine in two different samples of bleaching powder by iodometry (standard sodium thiosulphate solution to be supplied)

PART-B Physical Chemistry

1. Determination of density using specific gravity bottle and viscosity of liquids using Ostwald'sviscometer(Ethylacetate,Toluene,Chloroform,Chlorobenzeneoranyothernon-hazardousliquids)
2. Determinationofthedensityusingspecificgravitybottleandsurfacetensionofliquidsusing Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardousliquids
3. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water &Sucrose)
4. Determination of partition/distribution coefficient - i) Acetic acid in water and cyclohexane. ii) Acetic acid in Water and Butanol. iii) Benzoic acid in water and toluene.
5. Determination of rate constant of decomposition of H2O2 catalyzed byFeCl3
6. Determination of percentage composition of NaCl solution by determining miscibility temperature of phenol-water system.

LEARNING OUTCOMES / COURSE OUTCOMES

Chemistry as Discipline Specific Course (DSC)

B.Sc. Semester II

CHEMISTRY:2

- Understand principles of titrimetricanalysis.
- Understand principles of different type's titrations. Titration curves for all types ofacids – base titrations.
- Gain knowledge about balancing redox equations, titration curves, theory of redox indicators and applications.
- Understand titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and theirdifferences.
- Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water.
- Understand periodic table, classification and properties of s p d and f block elements
- Understand different scales for the measurement of electro-negativity and factors affecting it.
- Understand the chemistry of the hydrides, carbides, oxides and halides of group 13 to 17
- Understand nucleophilic substitution at saturated carbon, energy profile diagram stereochemistry and factors affecting S_N1 and S_N2 reactions.
- Aromatic electrophilic substitution reactions like nitration sulphonation Friedel-Crafts reactions

- Understand liquid crystals, classification with examples
- Understand the different forms of solids, laws of crystallography , miller indices and its calculation, X-ray diffraction studies. Brags law and its equation
- Defects in solids , properties of glasses and concept of liquid crystals

CHEMISTRY LAB - Volumetric (analytical) and physical praticals):P-2

After studying this course and performing the experiments set in it student will be ableto:

1. Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standardsolutions.
2. Explain the principles of acid-base, redox and iodometrictitrations.
3. Describe the significance of inorganic quantitativeanalysis.
4. Determine of density followed by the determination of viscosity and surface tension of different liquid samples.
5. Determination of partition coefficient of different liquid mixtures
6. Determination of rate constant in the decomposition reaction of hydrogen peroxide

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Reference Books for Discipline Specific Course

Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J.& Denney, R.C.
2. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons,1989.
3. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods ofAnalysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
4. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York,2004.
5. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman,2001.
6. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage LearningIndia Ed,2017.
7. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand,1974.

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS,1991.
2. Cotton, F.A., Wilkinson, G. &Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed.,Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley &Sons.
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Organic Chemistry

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2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi,2004.
3. McMurry, J.E. Fundamentals of Organic Chemistry, 7thEd. Cengage Learning India Edition,2013.
4. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi(1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, NewDelhi.
6. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson,2010.
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9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London(2004).
10. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill(2000).
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12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press,1998.
13. Organic Chemistry - L. Ferguson, Von Nostrand,1985.
14. Organic Chemistry - M. K. Jain, Nagin & Co.,1987.
15. Organic Chemistry- Mehta and Mehta, PHI Learning Pvt. Ltd, NewDelhi,2005.

Physical Chemistry

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill,2007.
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3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi,2009.
4. P.W. Atkins: Physical Chemistry,2002.
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6. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co.,1993.
7. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd.,1982.
8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand &Co. 1987.
9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons,1992.
10. Physical Chemistry - G. M. Barrow, McGraw Hill,1986.
11. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House,1985.
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., NewDelhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York,1981.

Open Elective Course - Semester – I

Title of the Course: OE-1: CHEMISTRY IN DAILY LIFE

Unit- I

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, determination of methyl alcohol in alcoholic beverages.
Food additives, adulterants, and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate.
Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residues in food. [14 hours]

Unit- II

Vitamins: Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1.
Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test.
Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents, composition and uses [14 hours]

Unit- III

Chemical and Renewable Energy Sources:
principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer.
Polymers: Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronic, automobile components, medical fields, and aerospace materials. Problems of plastic waste management. Strategies for the development of environment-friendly polymers.
[14hours]

COURSE OUTCOMES OEC-1 Chemistry

On completion of the course students will be able to:

1. Understand the chemical constituents in various day to day materials using by a commonman.
2. Understand the chemical constituents in vitamins, soaps and detergents
3. Understand the renewable chemical energy resources
4. Understand different types of polymers and their applications.

Reference Books

1. B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry- Ashtoush Kar.
3. Analysis of Foods – H.E. Cox: 13.
4. Chemical Analysis of Foods – H.E. Cox and Pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4thed. New Age International (1998)
6. Physical Chemistry – P l Atkins and J. de Paula – 7thEd. 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 (Prentice Hall).

Open Elective Course - Semester – II

Title of the Course: OE-2: Molecules of Life

UNIT I

Carbohydrates

Classification of carbohydrates, reducing and non-reducing sugars, General properties of glucose and fructose, their open chain structures. Epimers, mutarotation and anomers.

Linkage between monosaccharides, structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

Amino Acids, Peptides and Proteins

Classification of amino acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides.

UNIT II

Enzymes and correlation with drug action

Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity),

Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non competitive inhibition including allosteric inhibition).

Drug action-receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH2 group, double bond and aromatic ring

Lipids

Introduction to lipids, classification. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

UNIT III

Nucleic Acids

Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Concept of Energy in Biosystems

Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates

Course Outcome / Learning Outcome:

After studying this paper the student would be able to

1. Acquire knowledge about different types of sugars and their chemical structures.
2. Identify different types of amino acids and determine the structure of peptides.
3. Explain the actions of enzymes in our body and interpret enzyme inhibition.
4. Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism. Differentiate RNA and DNA and their replication. Explain production of energy in our body.

Reference Books:

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt.Ltd. (PearsonEducation).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7thEd.,
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. &Stryer, L. Biochemistry,2002.