AC 01.09.23 ITEM NO: 22.1

Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for
Program: Bachelor of Science
Course: F.Y.B.Sc (NEP 2023)
Subject: Chemistry

Choice Based Credit System (CBCS)
with effect from
Academic Year 2023-2024

Deccan Education Society's

Kirti M. Doongursee College (Autonomous) Proposed Curriculum as per

NEP 2020 Year of implementation- 2023-24

Name of the Department: Chemistry

Semester	Course Code	Course Title	Vertical	Credit
I	K23USCHEMJ111	Fundamental Chemistry-I	Major	2
	K23USCHEMJ112	Fundamental Chemistry-II	Major	2
	K23USCHEMJP111	Practical-I	Major	2
	K23USCHEOE131	Chemical Technology and Society	Open Elective	2
	K23USCHEVC141	Basic Analytical Chemistry	Vocational Skill Course	2
	K23USCHESC151	Fuel Chemistry	Skill Enhancement Course	2
II	K23USCHEMJ211	Fundamental Chemistry-III	Major	2
	K23USCHEMJ212	Fundamental Chemistry-IV	Major	2
	K23USCHEMJP211	Practical-II	Major	2
	K23USCHEMR221	Basics of Chemistry	Minor	2
	K23USCHEVC241	Pesticide Chemistry	Vocational Skill Course	2
	K23USCHESC251	Inorganic Materials of Industrial Importance	Skill Enhancement Course	2

PROGRAM OUTCOMES

PO	Description
A student completing Bachelor's Degree in **Science** Program will be able to	
PO1	Disciplinary Knowledge: Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate Programme. Execute strong theoretical and practical understanding generated from the specific graduate Programme in the area of work.
PO2	Critical Thinking and Problem solving: Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions
PO3	Social competence: Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.
PO4	Research-related skills and Scientific temper: Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research
PO5	Trans-disciplinary knowledge: Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
PO6	Personal and professional competence: Performing dependently and collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	Effective Citizenship and Ethics: Demonstrate empathetic social concern and equity centered national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	Environment and Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

SEM – I

Course Code	MAJOR Course	Credits	Lectures/ Week
K23USCHEMJ111	Paper I FUNDAMENTAL CHEMISTRY-I	2	2

Course Outcomes:

After successful completion of this course, students would be able to

CO1: Recall the mathematical formulae related to concentration, fundamental concepts of atomic structure, long form of periodic table.

CO2: Comprehend the concept of stoichiometry for chemical equations, various models of atomic structure, behavior of electrons in atomic structure, properties of periodicity of elements.

CO3 : Apply the knowledge of mathematics in chemistry.

CO4 : Compare the periodic properties of elements

Unit	Topics	No of Lectures
I	**1.1Chemical mathematics** Expressing concentration of solutions: Normality, molality, molarity, formality, mole fractions, weight ratio, volume ratio, weight to volume ratio, ppm, ppb, millimoles, milliequivalents (Numerical expected), Rules for drawing graph coordinates etc., Equation of straight line, slope, and intercept, plotting the graph from the data. Algebraic, logarithmic, and exponential functions	15
II	**2.1 Atomic structure:** (Qualitative treatment only; it is expected that the learner knows the mathematical statements and understands their physical significance after completing this topic. No derivations of the mathematical equations required) a) Historical perspectives of the atomic structure; Rutherford's Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom. b) Hydrogenic atoms: 1. Simple principles of quantum mechanics;	15

	2. Atomic orbitals i) Hydrogenic energy levels ii) Shells, subshells and orbitals iii) Electron spin iv) Radial shapes of orbitals v) Radial distribution function vi) Angular shapes of orbitals. 3. Many Electron Atoms i) Penetration and shielding ii) Effective nuclear charge 4. Aufbau principle **2.2: Periodic Table and periodicity :** Introduction of Long form of Periodic Table; Classification for elements as s-block, p-block, d-block and f-block according to electronic configurations. Periodicity in the following properties : Atomic and ionic size; electron gain enthalpy; ionization enthalpy, effective nuclear charge (Slater's rule); electronegativity ; Pauling, Mulliken and Alfred Rochow electronegativities (Numerical problems expected, wherever applicable.)	

References:

Unit I

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).
3. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
4. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
5. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013).
6. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press (2014).
7. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd.,New Delhi (2004).
8. Levine I.N., Physical Chemistry, 6th Ed., Tata Mc Graw Hill (2010).
9. Metz C.R., 2000 Solved Problems in Chemistry, Schaum Series (2006).
10. Rice. Physical Chemistry, 2nd Ed., Oxford University Press: (2009).
11. Banwell C.N., Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill (1994).
12. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).

Unit II

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning
6. India Edition, 2002.

SEM – I

Course Code	MAJOR SEM - I	Credits	Lectures /Week
K23USCHEMJ112	**Paper II FUNDAMENTAL CHEMISTRY - II**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to-

CO1: To understand, and be able to apply, the rules of systematic nomenclature for compounds ie, to apply IUPAC rule in naming organic compounds, To correlate the systematic name with the structure of organic compound, Name the organic compounds for mono functional group when structure is given or vice versa (Common and IUPAC Names,Role of analytical chemistry ,Partial ,trace analysis Proximate and ,complete analysis ,definitions of various types of errors

CO2 : Types of bond fission,importance of transition state and intermediates in determining the course of reaction, General mechanism & factors affecting formation of specific products pertaining to Substitution, Elimination reaction,To gain experience to predict the functional group transformations,simple reaction mechanisms, and the synthesis of organic molecules by multi-step synthesis strategies Language of analytical chemistry ,types of analysis concept of accuracy and Precision ,types of analytical methods

CO3: Apply it to determine trace quantities of compounds also determine the types of compounds CO4 Qualitative and quantitative analysis of samples

Unit	**Topics**	No of Lectures
I	1.1 Classification and Nomenclature of Organic Compounds: Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds: Alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines their cyclic analogues.	15

	1.2 Fundamentals of organic reaction mechanism: Electronic Effects: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications. Dipole moment; Organic acids and bases; their relative strengths. Basic terms & concepts: : Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles; Nucleophilicity and basicity, Electrophilicity and acidity. Types (primary, secondary, tertiary, allyl, benzyl), shape and their relative stability of the following reactive intermediates:i. Carbocations ii. Carbanions and iii. Free radicals Introduction to types of organic reactions: Addition, Elimination and Substitution reaction. (With one example of each)	
II	1.1. Role of analytical chemistry 1.1.1 Language of analytical chemistry : important terms and their significance in analytical chemistry 1.1.2 Purpose of chemical analysis -Analysis based on i) On the nature of information required : Proximate ,Partial ,Trace and complete analysis ii) On the size of the sample used (macro ,semi micro and microanalysis) 1.1.3 Classical and Non classical methods of analysis their types and importance 1.2 Results of analysis (6L) 1.2.1 Errors of analysis and their types 1.2.2 Precision and Accuracy in analysis 1.2.3 Corrections in determinate errors (numericals, problems expected)	15

References:

Unit I

1. Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd. (Pearson Education).2012
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley

(India) Pvt Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013
5. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
6. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.

Unit II

References:

1. Instrumental Analysis by Douglas A. Skoog, F. James Holler, Stanley R. Crouch
2. Instrumental methods of analysis by Willard, H.H.; Merritt, L.L. Jr.; Dean, J.A.; Settle,7th Edition
3. Fundamental of Analytical Chemistry by Douglas A. Skoog, West, F. James Holler, S. R. Crouch
4. Modern Analytical Chemistry by David Harvey, McGraw-Hill Higher Education
5. Skoog et al. “Fundamentals of Analytical chemistry" Cengage Learning, Eight Edition, chapter 13, 14 and 15
6. Day and Underwood, “Quantitative analysis" prentice hall 1991, chapter3
7. S.M. Khopkar, “ Basic Concepts of Analytical Chemistry”, IInd Edition NewAge International Publisher
8. Gary D. Christan,” Analytical Chemistry”, VIth Edition, Wiley Students Edition, Chapter No 8,9,10 5) Fundamental of Analytical Chemistry by Douglas A. Skoog, West, F. James Holler, S. R. Crouch

Course Code	OPEN ELECTIVE SEM – I	Credits	Lectures/ Week
K23USCHEOE131	Paper-I CHEMICAL TECHNOLOGY AND SOCIETY	2	2

Course Outcomes:

After successful completion of this course, students would be able to

CO1 : Recollect - Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption

CO2 : Understand - 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)

CO3: Apply Different - types of equipment needed in chemical technology

CO4: Interconversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs

Unit	Topics	No of Lectures
I	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.	15
II	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	15

References:

John W. Hill, Terry W. McCreary & Doris K. Kolb, Chemistry for changing times 13th Ed.

Course Code	SKILL ENHANCEMENT COURSE SEM – I	Credits	Lectures/ Week
K23USCHESC151	**Paper-I FUEL CHEMISTRY**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to

CO1- Recollect - energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

CO2 - Understand - Composition of crude petroleum, Refining and different types of petroleum products. Properties of lubricants (viscosity index, cloud point, pore point) and their determination

CO3 - Apply - 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)

CO4 - Refining and different types of petroleum products and their applications.

Unit	**Topics**	No of Lectures
I	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. Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications. synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.	15
II	Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels	15

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

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).

Course Code	VOCATIONAL SKILL COURSE SEM – I	Credits	Lectures/ Week
K23USCHEVC141	Paper I BASIC ANALYTICAL CHEMISTRY	2	2

Course Outcomes:

CO1 : Constituents of deodorants ,soil adulterants in coffee tea ,turmeric powder

CO2: Understand the reason of adulteration ,food preservation and food processing

CO3: Apply to determine the constituents in soil and deodorants

CO4: Analyze the adulterants in various food products

Unit	Topics	No of Lectures
I	**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. **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.	15

	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. **Chromatography:** Definition, general introduction on principles of chromatography, paper chromatography, TLC etc. a. Paper chromatographic separation of mixture of metal ion (Fe3+ and Al3+). 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).	
II	**Suggested Applications (Any one)**: a. To study the use of phenolphthalein in trap cases. b. To analyze arson accelerants. c. To carry out analysis of gasoline. **Suggested Instrumental demonstrations:** a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.	15

	b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets. c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink	

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).

SEM-I Completed

Course Code	MAJOR SEM – II	Credits	Lectures/ Week
K23USCHEMJ211	**Paper I FUNDAMENTAL CHEMISTRY – III**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to-

CO1 : Define the terms and laws involved in chemical thermodynamics, acid base theory, Qualitative Analysis

CO2: Understand the concepts of thermodynamic parameters.

CO3 : Applications of Qualitative Analysis and acid base theory in organic reactions..

CO4 : Volumetric analysis of strong acid and strong base.

Unit	**Topics**	No of Lectures
I	**Chemical thermodynamics** Thermodynamic terms: System, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state functions and path functions, zeroth law of thermodynamics First law of thermodynamics: Concept of heat (q), work (w), internal energy (U), statement of the first law, enthalpy, the relation between heat capacities, sign conventions, calculations of heat (q), work (w), internal energy (U), and enthalpy (H) (Numerical expected) Thermochemistry: Heats of reactions, standard states, enthalpy of formation of molecules, enthalpy of combustion and its applications, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equation (Numerical expected)	15
II	**2.1 Concept of Qualitative Analysis (7L)** a) Testing of Gaseous Evolutes, Role of Papers impregnated with Reagents in qualitative analysis (with reference to papers impregnated with starch iodide, potassium dichromate, lead acetate, dimethylglyoxime and oxine reagents). b) Precipitation equilibria, effect of common ions,	15

	uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds (Balanced chemical equations and numerical problems expected) **2.2 Acid Base Theories (8L)** Arrhenius, Lowry- Bronsted, Lewis, Solvent – Solute concept of acids and bases, Hard and Soft acids and bases and its applications. Applications of acid base chemistry in: i) Understanding organic reactions like Friedel Craft's (acylation/alkylation) reaction ii) Volumetric analysis wit h special reference to calculation of titration curve involving strong acid and strong base.	

References:

Unit I

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).
3. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
4. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
5. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013).
6. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press (2014).
7. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd.,New Delhi (2004).
8. Levine I.N., Physical Chemistry, 6th Ed., Tata Mc Graw Hill (2010).
9. Metz C.R., 2000 Solved Problems in Chemistry, Schaum Series (2006).
10. Rice. Physical Chemistry, 2nd Ed., Oxford University Press: (2009).
11. Banwell C.N., Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill (1994).
12. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).

Unit II

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.

4.Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.

5.Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.

Course Code	MAJOR SEM – II	Credits	Lectures/ Week
K23USCHEMJ212	Paper II FUNDAMENTAL CHEMISTRY-IV	2	2

Course Outcomes:

After successful completion of this course, students would be able to

CO1 : Recollect the separation techniques, Projection formulae of organic compounds

CO2 : Understand separation methods based on Solubilities, Gravity and Volatility**.** To understand Geometrical isomerism, Optical Isomerism of organic compounds.

CO3 : Apply it for separation based on Chromatography.

CO4 : Analyze organic and inorganic compounds with Chromatography. Conformational analysis of organic compounds.

Unit	Topics	No of Lectures
I	Stereochemistry-I: Projection formulae: Flying Wedge projection, Fischer Projection,Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3-dichlorobutane) and their interconversions; Geometrical isomerism in alkene and cycloalkanes: cis–trans and syn-anti isomerism E/Z notations with C.I.P rules.Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Diastereoisomers, meso structures, racemic mixture and resolution (methods of resolution not expected). Relative and absolute configuration: D/L and R/S designations. Conformational analysis of alkanes (ethane, propane and n-butane); Relative stability with energy diagrams.	15
II	Methods of separation 1.1 An introduction to analytical separations and its importance in analysis 1.2 Estimate an analyte without separation 1.3 Based on solubilities (precipitation ,filtration	15

	,crystallization) Based on volatility :Distillation (types of distillation) Based on gravity : centrifugation(types of Centrifuging devices) Based on Electrical effects -Electrophoresis Based on the retention capacity of the stationary phase - chromatography(types of chromatography) Based on two immiscible Phases _ solvent extraction Based on capacity to exchange with a resin - ion exchange chromatography Introduction to chromatography: Classification of chromatographic methods- Paper chromatography- Principles, technique and applications of Paper chromatography Thin layer chromatography- Principle, technique and applications in determining purity of the solute and following the progress of reaction	

References:

Unit-I

1. Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd. (Pearson Education).2012
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.

Unit II

References:

1. Instrumental Analysis by Douglas A. Skoog, F. James Holler, Stanley R. Crou
2. Instrumental methods of analysis by Willard, H.H.; Merritt, L.L. Jr.; Dean, J.A.; Settle,7th Edition
3. Fundamental of Analytical Chemistry by Douglas A. Skoog, West, F. James Holler, S.R. Crouch
4. Day and Underwood, “Quantitative analysis" prentice hall 1991, chapter3
5. Modern Analytical Chemistry by David Harvey, McGraw-Hill Higher Education
6. Skoog et al. “Fundamentals of Analytical chemistry" Cengage Learning, Eight Edition, chapter 13, 14 and 15

7. Day and Underwood, “Quantitative analysis" prentice hall 1991, chapter3
8. S.M. Khopkar, “ Basic Concepts of Analytical Chemistry”, IInd Edition NewAge International Publisher
9. Gary D. Christan,” Analytical Chemistry”, VIth Edition, Wiley Students Edition, Chapter No 8,9,10
10. Fundamental of Analytical Chemistry by Douglas A. Skoog, West, F. James Holler, S.
11. R. Crouch 6) Modern Analytical Chemistry , David Harvey (page numbers 232 -265)
12. Instrumental Methods of Chemical Analysis by Gurdeep R. Chatwal , Sham K.Anand pp 2.107-2.148
13. Principles of Instrumental Analysis by Skoog, Holler, Nieman, 5th Edition pp 143-172.
14. Instrumental Methods of Analysis by Willard, Merritt, Dean, Settle 7th Edition pp 118-181.

Course Code	MINOR SEM – II	Credits	Lectures/ Week
K23USCHEMR221	**Paper-I BASICS OF CHEMISTRY**	**2**	**2**

CO1: Remember the definitions of terms such as Normality, molarity, molality etc.. Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom. Recollect definitions of α-Amino acids, Polypeptides and Proteins

CO2: Understand- the procedures of preparation of solutions in ppm,ppb,N,M etc. Rutherford's Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom. Structures of monosaccharides: Fischer projection (4-6 carbon monosaccharides) and Haworth formula (furanose and pyranose forms of pentoses and hexoses)etc.

CO3: Preparation of solution of required concentration. Interconversion: open chain and Haworth forms of monosaccharides with 5 and 6 carbons.Reactions of D-glucose and D-fructose:

CO4: Determination of concentration of solutions: Normality, molality, molarity, formality, mole fractions, weight ratio

Unit	**Topics**	No of Lectures
I	Atomic structure: (Qualitative treatment only; it is expected that the learner knows the mathematical statements and understands their physical significance after completing this topic. No derivations of the mathematical equations required) a) Historical perspectives of the atomic structure; Rutherford's Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom. b) Hydrogenic atoms: 1. Simple principles of quantum mechanics	15
	1.2 Amino acids & Proteins 1.2.1α-Amino acids: General Structure, configuration, and classification based on structure and nutrition. Properties: pH dependency of ionic structure, isoelectric point and zwitter ion. Methods of preparations: Strecker synthesis, Gabriel phthalimide synthesis.	

II	1.2.2 Polypeptides and Proteins: nature of peptide bond. Nomenclature and representation of polypeptides (di-and tri-peptides) with examples Merrifield solid phase polypeptide synthesis. .Proteins: General idea of primary, Secondary, Tertiary & Quaternary structure. **Carbohydrates** Introduction: classification, reducing and non-reducing sugars, DL notation 2.2.1 Structures of monosaccharides: Fischer projection (4-6 carbon monosaccharides) and Haworth formula (furanose and pyranose forms of pentoses and hexoses) Interconversion: open chain and Haworth forms of monosaccharides with 5 and 6 carbons. 2.2.2 Reactions of D-glucose and D-fructose: Osazone formation (b) reduction: Hi/Ni, $NaBH_4$ (c) oxidation: bromine water, HNO_3, (d) acetylation (e) methylation:(d) and (e) with cyclic pyranose forms	15

References:

Unit I:

1. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).
2.Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).

Unit II:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002
6.Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd. (Pearson Education).2012
7. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).

Course Code	VOCATIONAL SKILL COURSE SEM – II	Credits	Lectures/ Week
K23USCHEVC241	Paper I PESTICIDE CHEMISTRY	2	2

CO1: Recollect - Natural and Synthetic Pesticides

CO2: Understand - benefits and adverse effects, changing concepts of pesticides, structure activity relationship

CO3: synthesis and technical manufacture and uses of representative pesticides

Preparation of simple organophosphates, phosphonates and thiophosphates

CO4: Analyze - To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications

Unit	Topics	No of Lectures
I	Theory - 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)	15
II	Practicals 1 To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications. 2 Preparation of simple organophosphates, phosphonates and thiophosphates	15

Reference Book:

 Cremlyn, R. Pesticides. Preparation and Modes of Action, John Wiley & Sons, New York, 1978

Course Code	SKILL ENHANCEMENT COURSE SEM – II	Credits	Lectures /Week
K23USCHESC251	Paper I INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	2	2

Course Outcomes:

CO1 : Recollect - 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

CO2 : Understand - Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, etc properties of elements in alloys. Manufacture of Steel

CO3 : Applied for determining be composition of fertilizer and alloy

CO4 : 1. Determination of free acidity in ammonium sulphate fertilizer.

2. Estimation of calcium in calcium ammonium nitrate fertilizer.

3. Estimation of phosphoric acid in superphosphate fertilizer.

4. Determination of composition of dolomite (by complexometric titration).

Unit	Topics	No of Lectures
I	**Silicate Industries** *Glass:* 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. **Fertilizers:** Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate,	15

	calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.	
II	**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. **Batteries:** Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.	15

Reference Books:

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics,* Wiley Publishers, New Delhi.
4. J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
5. P. C. Jain & M. Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.
7. B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

Evaluation Scheme for First Year (UG) under NEP

(2 Credits)

I. Internal Evaluation for Theory Courses – 20 Marks

Continuous Internal Assessment 1 (Seminar Presentations) – 20 Marks

II. External Examination for Theory Courses – 30 Marks

Duration: 2 Hours

Theory question paper pattern:

All questions are compulsory.

Question	Based on	Marks
Q.1	Unit-I	15
Q.2	Unit-II	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.
- Each unit will have 25% objective questions.

III. Practical Examination

- Each core subject carries 50 Marks
- Duration: 4Hours for each practical course
- Minimum 80% practical from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam