



SOMAIYA
VIDYAVIHAR

K J Somaiya College of Science & Commerce

Department: Chemistry

Somaiya

TRUST

F. Y. B.Sc. Syllabus

F. Y. B. Sc. Autonomous Syllabus

Department of Chemistry

K. J. Somaiya College of Science and Commerce

To be effective from 2018-19



F. Y. B. Sc. SEM I/II: Credits per Semester

Course	Credit
	Theory
I	02
II	02
Practical	02
Total	06
Per subject 6 credit	Total = 6 x 3= 18
Ability enhancement course	02
Total credits per semester	20

Evaluation pattern: Theory

External (60 M) + Internal (40 M)

External: End Sem Examination

Paper Pattern: F. Y. B. Sc. Semester I/II

External: 60 Marks

Duration: 2 hrs

Question No.	Module	Marks (with option)	Marks (without option)
Q 1	1	5 M × 5 Q = 25 M	5 M × 4 Q = 20 M
Q 2	2	5 M × 5 Q = 25 M	5 M × 4 Q = 20 M
Q 3	3	5 M × 5 Q = 25 M	5 M × 4 Q = 20 M

Each question will have sub questions a, b, c, d, e and out of which any four questions should be answered.

Internal: 40 Marks: Continuous evaluation at department level.

Practical Evaluation: 50 Marks practical examination at the end of each semester per paper.

Semester I

Course-I (Paper I)

Course code: 18US1CH1

Module 1: Atomic Structure

1.1	Quantum mechanics: What is Quantum mechanics? Classical mechanics to quantum mechanics. Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom.	3L
1.2	Atomic orbitals: Radial and angular parts of the wave functions (atomic orbitals) and their variations for s, p and d orbitals (only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals.	4L
1.3	Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s . Shapes of s, p and d atomic orbitals, nodal planes. spin quantum number (s) and magnetic spin quantum number (m_s). Rules for filling electrons in various orbitals, Electronic configurations of the atoms.	5L
Reference Books		
1	Selected topics in Inorganic Chemistry, Malik, Tuli, Madan, S. Chand Publications, Revised edition.	
2	Principles of Inorganic Chemistry, Puri, Sharma and Kalia, 6 th edition	
3	Fundamental concepts of Inorganic Chemistry, Asim K Das, Volume 2, 2 nd edition	

Module 2: Periodic table and Periodicity properties

2.1	1) The need for classification of elements 2) Attempts of classification of elements :- Doberiner's triads, Law of octaves, Mendeleev's periodic table. 3) Modern periodic Law, cause of periodicity, Long form of periodic table. 4) IUPAC nomenclature for elements with $Z > 100$ 5) Division of periodic table into s, p, d & f blocks.	4L
2.2	Periodic trends in properties. 1) Valency , 2) Atomic volume, 3) Atomic size, 4) Ionization energy, 5) Electron affinity, 6) Melting & boiling point, 7) Electro negativity, 8) Electro positivity & metallic character.	5L
2.3	1) Effective nuclear charge and shielding effect, 2) Slater's rule (problems expected).	2L
2.4	Determination of Electro negativity using : 1) Mullikan's scale, 2) Pauling's scale.	1L
Reference Books		
1	Concise Inorganic Chemistry, J. D. Lee, 6 th Edition.	
2	Principles of Inorganic Chemistry, Puri, Sharma and Kalia, 6 th edition	
3	Selected topics in Inorganic Chemistry, Malik, Tuli, Madan, S. Chand Publications, Revised edition.	

Module 3: Chemical Bonding

3.1	Ionic Bond: Formation of Ionic bond, energy changes in the formation of ionic bond, characteristics of electrovalent compound, Lattice energy, solvation energy, Born-Haber cycle, Madelung constant and Kapustinskii equation.	4L
3.2	Covalent bond: Formation of covalent bond, energy changes in the formation of covalent bond, electron dot structure, characteristics of covalent bond, single and multiple bonding, coordinate covalent bond.	3L
3.3	VBT Sigma and Pi bonds, concept of hybridization, types of hybridization - sp, sp ² , sp ³ with respect to inorganic molecules like BeCl ₂ , BF ₃ , SiCl ₄ and organic molecules like ethane, ethene and ethyne. Shapes of chemical species on the basis of VSEPR theory - NH ₃ , ClF ₃ , BrF ₅ , PX ₃ , ICl ₂ ⁻ and TeF ₅ ⁻ .	5L
Reference Books		
1	Fundamental concepts of Inorganic Chemistry, Asim K Das, Volume 2, 2 nd edition.	
2	Principles of Inorganic Chemistry, Puri, Sharma and Kalia, 6 th edition	
3	Selected topics in Inorganic Chemistry, Malik, Tuli, Madan, S. Chand Publications, Revised edition.	
4	Textbook of inorganic chemistry, Anilkumar De.	

Course-II (Paper II)
Course code: 18US1CH2

Module 1: Fundamental of Organic Chemistry and IUPAC Nomenclature of organic compounds

1.1	Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.	6L
1.2	IUPAC nomenclature of Organic compounds: Types of organic compounds. Nomenclature of aliphatic compounds eg. Nomenclature of bifunctional compounds. Priority rules. Nomenclature of benzene derivatives, mono, di and polysubstituted derivatives.	6L
	Reference Books	
1	Organic Chemistry, Morrison Boyd & Bhattacharjee, edition 7 th , 2012-Pearson India.	
2	A Logical Approach To Modern Organic Chemistry, Jagdamba Singh, Pragati Prakashan.	
3	A Textbook of Organic Chemistry by Bahl Arun, Bahl B. S., 22 nd edition, Chand publications.	

Module 2: Aliphatic Hydrocarbons

2.1	Alkanes: (Upto 5 Carbons) Natural resources and applications, Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation	4L
2.2	Alkenes: (Upto 5 Carbons) Natural resources and applications, Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO_4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, Hydroboration-oxidation.	4L
2.3	Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alk. KMnO_4 .	4L
Reference Books		
1	Organic Chemistry, Morrison Boyd & Bhattacharjee, edition 7 th , 2012-Pearson India.	
2	A Logical Approach To Modern Organic Chemistry, Jagdamba Singh, Pragati Prakashan.	
3	A Textbook of Organic Chemistry by Bahl Arun, Bahl B. S., 22 nd edition, Chand publications.	

Module 3: Principles of Qualitative and Quantitative Analysis

3.1	Qualitative Analysis: Types of qualitative analysis on the basis of sample size: Micro, semi micro, ultra micro, micro analysis, Factors affecting precipitation equilibrium: Common ion effect, complexation and oxidation number, Theory of elemental analysis of organic compounds.	3L
3.2	Quantitative Analysis: Classification of quantitative analytical methods: Classical methods and instrumental methods, Gravimetric analysis: Indirect gravimetric method-principle, technique and applications. Volumetric analysis: calibration of apparatus, general principles of volumetric analysis, Primary and secondary standards: properties, examples of primary and secondary standards used in different titrimetric methods. Preparation of standard solutions (sodium hydroxide, succinic acid, oxalic acid, potassium permanganate, potassium dichromate), Preparation of standard acids and bases: hydrochloric acid, acetic acid, sulphuric acid, ammonia. (Numerical expected)	5L
3.3	Classification of titrations: Acid base, redox, complexometric and precipitation. Acid base titrations: different types of acid base titrations, Indicators used in acid base titrations. Redox titrations: Types of oxidising and reducing agents, Reactions involved in different types of redox titrations and detection of end point in redox titrations.	4L
	Reference Books	
1	Vogel's qualitative inorganic analysis, 7 th edition.	
2	Quantitative Analysis, 4 th Edition (Day, R. A.; Underwood, A. L.)	
3	Vogel's quantitative inorganic analysis, 6 th edition.	
4	Fundamental of Analytical chemistry, D. A. Skoog.	



Chemistry Practicals (Sem I)

Course code	Experiments
18US 1CHP	Calibration of apparatus and Standardisation of solutions: <ol style="list-style-type: none">1. Calibration of pipettes and standard flasks2. Standardisation of NaOH using succinic acid and Standardisation of KMnO_4 using oxalic acid.
	Volumetric Analysis -Estimation: <ol style="list-style-type: none">1. Estimation of Sodium carbonate & sodium bicarbonate present in a mixture.2. Estimation of Fe(II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicators.
	Organic chemistry : Identification of Organic Compounds

Semester II

Course-I (Paper I)

Course code: 18US2CH1

Module 1: Thermodynamics & Chemical Energetics

1.1	Introduction and significance of thermodynamics. Some basic terms of thermodynamics, First Law of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, Applications of Hess's Law, integral and differential enthalpies of solution and dilution.	6L
1.2	Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchoff's equation. (Numericals expected).	3L
1.3	Second Law of thermodynamics: Concept of entropy and Carnot Cycle, Statement of Third law of thermodynamics.	3L
Reference Books		
1	Puri, Sharma and Pathania, Principles of Physical Chemistry, 44 th Edn., Vishal Publishing Co.	
2	Arun Bahl, J.D. Tuli, Essentials of Physical Chemistry, S. Chand Publishing Co.	
3	Samuel Glasstone, Text book of Physical Chemistry.	

Module 2: Chemical Equilibrium

2.1	Free energy change in a chemical reaction. Thermodynamic derivation of the law of mass action, van't Hoff reaction isotherm, Distinction between ΔG and ΔG^0 , Relation between K_p , K_c and K_x .	4L
2.2	Homogeneous and heterogeneous equilibria, Characteristics of equilibrium constant. Temperature dependence of the equilibrium constant- Integrated form of the Vant Hoff's Equation. Pressure dependence of equilibrium constant.	6L
2.3	Factors that alter the state of equilibrium- LeChatelier's Principle, examples. (Numericals expected)	2L
Reference Books		
1	Puri, Sharma and Pathania, Principles of Physical Chemistry, 44 th Edn., Vishal Publishing Co.	
2	Arun Bahl, J.D. Tuli, Essentials of Physical Chemistry, S. Chand Publishing Co	
3	Samuel Glasstone, Text book of Physical Chemistry	

Module 3: Ionic Equilibria

3.1	Strong, moderate and weak electrolytes, degree of ionisation, factors affecting degree of ionisation, Ionisation constant and ionic product of water. Ionisation of weak acids and bases.	4L
3.2	pH scale, common ion effect. Salt hydrolysis, calculation of hydrolysis constant, degree of hydrolysis for different salts. Buffer solutions, buffer action, buffer capacity, Henderson's equation for acidic and basic buffer solution (numericals expected).	6L
3.3	Solubility and solubility product with applications.	2L
Reference Books		
1	Puri, Sharma and Pathania, Principles of Physical Chemistry, 44 th Edn., Vishal Publishing Co.	
2	Arun Bahl, J.D. Tuli, Essentials of Physical Chemistry, S. Chand Publishing Co.	
3	Samuel Glasstone, Text book of Physical Chemistry.	

Course-II (Paper II)
Course code: 18US2CH2

Module 1: Alkyl and Aryl Halides

1.1	Alkyl Halides (Upto 5 Carbons) Introduction and applications, Types of nucleophilic substitution (SN^1 , SN^2 and SN^i) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.	5L
1.2	Aryl Halides Introduction and applications, Preparation: (chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution with mechanism (replacement by $-OH$ group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.	7L
	Reference Books	
1	Organic Chemistry, Morrison Boyd & Bhattacharjee, edition 7 th , 2012-Pearson India.	
2	A Logical Approach To Modern Organic Chemistry, Jagdamba Singh, Pragati Prakashan	
3	A Textbook of Organic Chemistry by Bahl Arun, Bahl B. S., 22 nd edition, Chand publications.	

Module 2: Aromatic Hydrocarbons & Carboxylic acid derivatives (aliphatic)

2.1	Aromatic hydrocarbons Introduction and applications, Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution with mechanism: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).	6L
2.2	Carboxylic acid derivatives (aliphatic): (Upto 5 carbons) Introduction and applications, Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell-Vohlard-Zelinsky Reaction. Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their inter conversion. Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.	6L
	Reference Books	
1	Organic Chemistry, Morrison Boyd & Bhattacharjee, edition 7 th , 2012-Pearson India.	
2	A Logical Approach To Modern Organic Chemistry, Jagdamba Singh, Pragati Prakashan.	
3	A Textbook of Organic Chemistry by Bahl Arun, Bahl B. S., 22 nd edition, Chand publications.	

Module 3: Alcohols, Phenols and Ethers (Upto 5 Carbons), Aldehydes, Ketones

3.1	Alcohols: Preparation of 1 ^o , 2 ^o and 3 ^o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO ₄ , acidic dichromate, conc. HNO ₃). Oppenauer oxidation. Diols: (Upto 6 Carbons) Oxidation of diols. Pinacol-Pinacolone rearrangement.	6L
3.2	Phenols: Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer Tiemann Reaction, Gattermann-Koch Reaction, Houben-Hoesch Condensation, Schotten – Baumann Reaction. Ethers (aliphatic and aromatic): Cleavage of ethers with HI.	3L
3.3	Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde) Preparation: from acid chlorides and from nitriles. Reactions: Reaction with HCN, ROH, NaHSO ₃ , NH ₂ -G derivatives, Iodoform test, Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation, Clemmensen reduction and Wolff-Kishner reduction, Meerwein-Ponndorf-Verley reduction.	3L
Reference Books		
1	Organic Chemistry, Morrison Boyd & Bhattacharjee, edition 7 th , 2012-Pearson India.	
2	A Logical Approach To Modern Organic Chemistry, Jagdamba Singh, Pragati Prakashan.	
3	A Textbook of Organic Chemistry by Bahl Arun, Bahl B. S., 22 nd edition, Chand publications.	

Chemistry Practicals (Sem II)

18US2CHP	Physical Chemistry & Ionic Equilibria: <ol style="list-style-type: none">1. Determination of enthalpy of neutralisation of hydrochloric acid with sodium hydroxide.2. To determine the pH of a given solution through matching its colour developed by an indicator.3. To determine the pH of NH_4Cl, NaCl, Na_2CO_3 and CH_3COONa solutions using pH meter
	Organic Chemistry: <ol style="list-style-type: none">1. Preparation of<ol style="list-style-type: none">A. Ester HydrolysisB. 2,4-DNP of acetoneC. Nitro derivative of salicylic acid Recrystallization, determination of melting point and calculation of quantitative yield to be done.