SOPHIA COLLEGE (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Programme: Chemistry

F.Y.B.Sc.

Syllabus for the Academic Year 2018-2019

Programme Outline: FYBSc SEMESTER I

Course Code	Unit	Topic	Credits	L/week
SBSCHE101	I	1.1Chemical thermodynamics 1.2 Chemical calculations	2	6
	II	2.1 Atomic structure 2.2 Periodic table and periodicity		
	III	3.1 Classification and Nomenclature of organic compounds 3.2 Bonding and structure of organic compounds 3.3 Fundamentals of organic reaction mechanisms		
SBSCHE102	I	1.1 Chemical kinetics 1.2 Liquid State	2	6
	II	2.1 History of science 2.2 Comparative chemistry of main group elements		
	III	3.1 Stereoisomerism 3.2 Representation of stereoisomers 3.3 Nomenclature, relative and absolute configuration		
SBSCHEP1	PRACTICAL COURSE		2	6

Programme Outline: FYBSc SEMESTER II

Course Code	Unit	Topic	Credits	L/week
SBSCHE201	I	1.1 Gaseous state 1.2 Chemical equilibria and thermodynamic parameters. 1.3 Catalysis	2	6
	II	2.1 Concept of qualitative analysis 2.2 Acid base theory		
	III	3.1 Carbon carbon sigma bond 3.2 Carbon carbon pi bond		
SBSCHE202	I	1.1 Ionic equilibria 1.2 Molecular spectroscopy	2	6
	II	2.1 Chemical bond and reactivity 2.2 Oxidation reduction chemistry		
	III	3.1 Stereochemistry of cycloalkanes and conformational analysis 3.2 Aromatic hydrocarbons 3.3 Electrophilic aromatic substitution		
SBSCHEP2	PRACTICAL COURSE		2	6

Colour code
Green: Environment
Violet:Skill

Preamble

Programme: BSc Chemistry

Chemistry - a vibrant and ever growing science that encompasses every aspect of our lives. The fascinating study of matter and its applications is vital in areas like drug designing, material science, nanotechnology and most importantly, 'green chemistry', areas that are beneficial to both humanity and the environment. Bachelor's degree in Chemistry is the culmination of in-depth knowledge of Inorganic, Organic and Physical chemistry, Analytical chemistry and specialized courses such as Pharmaceutical Chemistry, spectroscopy, Nanoscience, Forensic Science, Cosmeticology, Food chemistry, Dairy Chemistry, Environmental chemistry and so on.

The learning objectives are designed to provide a focused outcome based syllabus with an agenda to structure the teaching learning experiences in a more student centric manner. This programme helps learners in building a solid foundation for higher studies in Chemistry. The hands-on experience the students gain in Practical enable them to apply theoretical knowledge acquired to solve problems in everyday life, think critically and innovatively. The syllabus is designed so that the student starts from the basic concepts of chemistry and will gradually move towards the advanced level. They are given opportunities to improve their creativity, scientific writing and communication skills through assignments and other co-curricular activities in all the semesters. The credit courses on "Positive Health in Women" and "Innovation in Natural dyeing and Entrepreneurship Skills" offered by the department further enhances their life skills and helps them evolve as entrepreneurs.

Students completing this programme will be equipped with knowledge of the concepts of Chemistry, interpret data and present their findings to both the scientific community and laymen. Completion of this programme will also enable the learners to join teaching professions, conducting research in Industry and Government run research labs.

PROGRAMME OBJECTIVES	
PO1	The students are expected to understand the basic concepts in chemistry and be aware of the recent development in the subject area.
PO2	To inculcate critical thinking and scientific attitude in the students.
PO3	The students should be able to apply the theoretical knowledge and practical skills acquired to solve the real world problems and environmental issues.

PROGRAMME SPECIFIC OBJECTIVES	
PSO1	**Core competency:** The chemistry graduates are expected to gain the theoretical and practical knowledge of the basic concepts in chemistry.
PSO2	**Skill development:** They would acquire necessary skills and training to pursue higher studies in the field of chemistry and to be an entrepreneur.
PSO3	**Responsible citizens:** The students will get trained to adopt and practice sustainable techniques for their personal growth and to address societal and environmental problems.

Syllabus for Approval

Sr No	Heading	Particulars
1	Title of course	FYBSc Chemistry
2	Passing marks	40%
3	Ordinance/Regulation (if any)	
4	No. of Semester	Two
5	Level	UG
6	Pattern	Semester
7	To be implemented from Academic year	2019-20

Date:

BOS Chairperson
Dr I A Mendes

Convener
Dr Santosh Haram

Chemistry Semester I

Paper I Course Code SBSCHE101

COURSE OBJECTIVES:

CO 1	To understand the fundamental concepts of thermodynamics and relationship among thermodynamic parameters
CO 2	To understand the calculations involved in preparation of solutions of different concentrations.
CO 3	To clarify the basics of atomic structure using quantum mechanics: shapes of orbital
CO 3	To understand the special features of the quantum mechanical model of an atom and to define an atomic orbital in terms of its quantum numbers
CO 4	To correlate the chemical properties of elements with their position in the periodic table
CO 5	To understand the method of naming organic compounds systematically.
CO 6	To understand the bonding and geometry of different organic compounds
CO 7	To understand the fundamental concepts of organic chemistry and its effect on acidity, basicity, reactivity of organic compounds.

COURSE LEARNING OUTCOMES: The learner will be able to

CLO 1	Derive relationship between different thermodynamic variables and solve numericals based on data given
CLO 2	Calculate amounts of solutes required for preparation of different solutions.
CLO 3	Explain the concepts of nodes and the shapes of the orbital with correct signs of wave functions.
CLO 4	Explain experimental observables by using the quantum mechanical model studied
CLO 5	Capable of discerning the chemical properties of elements based on parameters with predictable trends across periods and groups in periodic table
CLO 6	Identify the various functional groups and name them using IUPAC nomenclature

UNIT	TOPIC	LECT
	PHYSICAL CHEMISTRY	
I	**Chemical Thermodynamics**	10
1.1	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 first law, enthalpy, relation between heat capacities, sign conventions, calculations of heat (q), work (w), internal energy (U), and enthalpy (H) (Numericals 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 (intergrated form) (Numericals expected)	
1.2	**Chemical Calculations**	5
	Expressing concentration of solutions: Normality, molality, molarity, formality, mole fractions, weight ratio, volume ratio, weight to volume ratio, ppm, ppb, millimoles, milliequivalents (Numericals expected)	
	INORGANIC CHEMISTRY	
2.1	**Atomic Structure**	10
	a) Historical perspectives of the atomic structure: Rutherford's Atomic Model, Bohr's theory, its limitations and the atomic spectrum of hydrogen atoms. Structure of hydrogen atom. b) Hydrogenic system 1. Postulates of quantum mechanics 2. Atomic orbitals i) Hydrogenic energy levels ii) Shells, subshells and orbitals iii) Electron spin iv) Radial components of orbitals v) Radial distribution function vi) Angular shapes of orbitals. 3. Many Electron system	

	i) Penetration and shielding ii) Effective nuclear charge 4. Aufbau principle	
2.2	**Periodic Table and periodicity**	5
	Long form of Periodic Table; Classification for elements as main group, transition and inner transition elements; Periodicity in the following properties : Atomic and ionic size; electron gain, enthalpy; ionization enthalpy, effective nuclear charge (Slater's rule); electronegativity ; Pauling, Mulliken and Alred Rochow electronegativities (Numericals expected, wherever applicable.)	
	ORGANIC CHEMISTRY	
3.1	**Classification and Nomenclature of Organic Compounds**	5
	Review of basic rules of IUPAC nomenclature. 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; including their cyclic analogues.	
3.2	**Bonding and Structure of organic compounds:**	4
3.2.1	**Hybridization**: hybridization of carbon,nitrogen and oxygen (sp^3, sp^2 sp)in the following compounds.(alcohol, ether, aldehyde, ketone, carboxylic acid, ester, amine, imine, amide and cyanide)	
3.2.2	**Overlap of atomic orbitals**: Overlaps of atomic orbitals to form sigma and pi bonds, shapes of organic molecules.	
3.2.3	**Shapes of molecules**: Influence of hybridization on bond properties (as applicable to ethane, ethene, ethyne)	
3.3	**Fundamentals of organic reaction mechanism**	
3.3.1	**Introduction:** Lewis structure, Formal Charge ,types of arrows, homolytic and heterolytic fission with suitable examples. Electrophiles and Nucleophiles; Nucleophilicity and basicity;	2
3.3.2	**Reactive intermediates: carbocation, carbanions and free radicals** types ,structure, shape and their relative stability (primary,	2

	secondary, tertiary, allyl, benzyl)	
3.3.3	**Electronic Effects:** Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids including carbon acids and bases; their relative strengths.	2

Paper II Course Code SBSCHE102

COURSE OBJECTIVES:

CO 1	To understand the fundamental concepts of chemical kinetics.
CO 2	To recognise different properties of liquid states and instruments for their measurement.
CO 3	To understand the properties of main group elements
CO 4	To understand the terminology, nomenclature and basic concepts related to stereochemistry.
CO 5	To acquaint with the various projections used and conformational analysis of organic molecules
CO 6	To understand the method of assigning configuration to chiral compounds with and without a stereogenic centre

COURSE LEARNING OUTCOMES : Learner will be able to

CLO 1	Interpret data obtained from various kinetic reactions and identify order of reaction
CLO 2	Calculate the values of various properties exhibited by liquids from experimental data
CLO 3	Write and compare properties of main group elements.
CLO 4	Distinguish between the different types of stereoisomers.
CLO 5	Assign configuration to compounds and correlate between the structure and configuration of stereoisomers and the chemical and biological properties

UNIT	TOPIC	LECT
I	**PHYSICAL CHEMISTRY_**	
1.1	**Chemical Kinetics**	**8**
	Rate of reaction, rate constant, measurement of reaction rates, order and molecularity of reaction, integrated rate equation of first and second order reactions (with equal initial concentration of reactants) (Numericals expected) Determination of order of reaction by (a) Integration method (b) Graphical method (c) Ostwald's isolation method (d) Half time method (Numericals expected)	
1.2	**Liquid State**	**7**
	Surface tension: Introduction, methods of determination of surface tension by drop number method (Numericals expected) **Viscosity:** Introduction, coefficient of viscosity, relative viscosity, specific viscosity, reduced viscosity, determination of viscosity by Ostwald's viscometer (Numericals expected) **Refractive index:** Introduction, specific refraction, molar refraction and polarizability, determination of refractive index by Abbe's refractometer (Numericals expected) **Liquid crystals:** Introduction, classification and structure of thermotropic phases (Nematic, smectic and cholesteric phases), applications of liquid crystals	
II	**INORGANIC CHEMISTRY**	
2.1	**History of Science:** Development of science over the 19th and 20th century, Nobel prizes in chemistry.	**2**
2.2	**Comparative Chemistry of Main Group Elements**	**13**
	Metallic and non-metallic nature, oxidation states, electronegativity, anomalous behaviour of second period elements, allotropy, catenation, diagonal relationship. Comparative chemistry of carbides, nitrides, oxides and hydrides of group I and group II elements. Oxides of carbon, oxides and oxyacids of sulphur and nitrogen with respect to environmental aspects.	
III	ORGANIC CHEMISTRY : **Stereochemistry I**	**15**
3.1	**Stereoisomerism:**Chirality versus stereogenicity,classification of stereisomers Definition:enantiomers diasteremers asymmetric carbon	
3.2	**Representation of stereoisomers:** Flying-wedge model, Fischer	

	Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3 dichlorobutane) and their interconversions	
3.3	**Nomenclature relative and absolute configuration**: D/L and R/S designations. Optical activity vs chirality: compounds with one chiral centre Optical activity, Specific Rotation, racemic mixture and resolution (methods of resolution not expected). Molecules with two, similar and dissimilar chiral-centres, Distereoisomers, meso structures, Geometrical isomerism in alkene and cycloalkanes: cis–trans and syn-anti isomerism E/Z notations with C.I.P rules.Conformation analysis of alkanes (ethane), relative stability with energy diagram	

Semester II

Paper I Course Code SBSCHE201

COURSE OBJECTIVES

CO 1	To understand different laws applicable to gases
CO 2	To understand various concepts of chemical equilibrium and Le Chatelier's principle
CO 3	To introduce to catalysis and different types of catalyst
CO 4	To apply the concept of the solubility product and pH of the medium on precipitation of ionic compounds
CO 5	To study different acid-base theories
CO 6	To learn various methods of preparation of hydrocarbons
CO 7	To understand the mechanism of reactions of hydrocarbons.

COURSE LEARNING OUTCOMES: Learner will be able to

CLO 1	Solve numericals based on gas laws
CLO 2	Apply Le Chatelier's principle and identify different parameters required for optimization of chemical reaction
CLO 3	Understand the experimental observations in the laboratory in semi-micro analysis with the concept of solubility product

CLO 4	Compare the different acid-base theories
CLO 5	Identify different types of catalyst and explain the mechanism of action
CLO 6	Write various preparative methods and predict the mechanisms of hydrocarbon

UNIT	TOPIC	LECT
I	**PHYSICAL CHEMISTRY**	
1.1	**Gaseous State:** Ideal gas laws, kinetic theory of gases, Maxwell-Boltzmann's distribution of velocities (qualitative discussion), ideal gases, real gases, compressibility factor, Boyle's temperature (Numericals expected) Deviation from ideal gas laws, reasons for deviation from ideal gas laws, Van der Waals equation of state (Numericals expected), Joule-Thomson effect: qualitative discussion and experimentation,inversion temperature.	8
1.2	**Chemical Equilibria and Thermodynamic Parameters:** Reversible and irreversible reactions, law of mass action, dynamic equilibria, equilibrium constant K_c and K_p, relationship between K_c and K_p, Le Chatelier's principle with special reference to Habers process, factors affecting chemical equilibrium (Numericals expected)	5
1.3	**Catalysis:** General characteristics of catalytic reactions, types of catalysis, effects of catalysis, principle of chemical and adsorption theory of catalysis(Derivation not expected)	2
II	**INORGANIC CHEMISTRY**	
2.1	**Concept of Qualitative Analysis:**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 (Numericals expected), diverse ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations)	8
2.2	**Acid Base Theories:** Arrhenius, Lowry- Bronsted, Lewis, Usanovich concept, Solvent – Solute concept of acids and bases, Hard and Soft acids and bases. Applications of HSAB Applications of acid base chemistry in understanding organic reactions like Friedel Craft's (acylation/alkylation) reaction	7
III	**ORGANIC CHEMISTRY: Chemistry of Aliphatic Hydrocarbons**	

3.1	**Carbon-Carbon sigma bonds: Chemistry of alkanes:** Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.	**3L**
3.2	**Carbon-Carbon pi-bonds:**	**12L**
3.2.1	**Formation of alkenes and alkynes by elimination reactions:** Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.	
3.2.2	**Reactions of alkenes:** Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition). Oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction(catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2-and 1, 4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylicbromination using N-bromosuccinimide. (propene,1-butene,toluene,ethylbenzene) (No Mechanism expected)	
3.2.3	**Reactions of alkynes:** Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes. (No mechanism expected)	

Paper II Course Code SBSCHE202

COURSE OBJECTIVES:

CO 1	To understand concept of ionic equilibria, pH and buffers
CO 2	To understand basic terms in spectroscopy and laws of visible spectroscopy
CO 3	To learn different types of chemical bonds and factors affecting their reactivity
CO 4	To study redox chemistry with respect to electrochemical reactions
CO 5	To understand the stereochemistry of cycloalkanes and aromatic hydrocarbons and their relative stability
CO 6	To understand the criteria of aromaticity
CO 7	To understand mechanism of reactions of aromatic hydrocarbons

COURSE LEARNING OUTCOMES: Learner will be able to

CLO 1	Calculate equilibrium constants and pH of aqueous solution and buffer
CLO 2	Identify and compare different types of spectroscopy and solve numericals based on Beer Lambert's law
CLO 3	Explain the bonding and factors affecting chemical bonds in inorganic molecules
CLO 4	Predict the outcome of redox reactions based on the electrochemical series
CLO 5	Explain the stereochemistry of cycloalkanes and predict the strain experienced by the compound.
CLO 6	Classify the organic compounds as aromatic and antiaromatic compounds
CLO 7	Predict the mechanisms for aromatic compounds

UNIT	TOPIC	LECT
I	PHYSICAL CHEMISTRY	
1.1	**Ionic Equilibria :**Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water, ionization of weak acids and bases, pH scale, common ion effect, dissociation constants of mono-, di- and triprotic acid (derivation for monoprotic acid only) Buffers: Introduction, types of buffers, derivation of Henderson equation for acidic and basic buffers, buffer action, buffer capacity (Numericals expected)	9
1.2	**Molecular Spectroscopy:**Electromagnetic radiation, electromagnetic spectrum, Planck's equation (Numericals expected) interaction of electromagnetic radiation with matter: Absorption, emission, scattering, fluorescence,electronic, vibrational and rotational transitions Basic terms: Radiant power, absorbance, transmittance, monochromatic light, polychromatic light, Absorptivity. Statement of Beer's Law ,Lambert's Law, Combined mathematical expression of Beer- Lambert's Law, Validity of Beer- Lambert's Law, Deviation from Beer-Lambert's Law. (Numericals expected)	**6**
II	**INORGANIC CHEMISTRY**	

2.1	**Chemical Bond and Reactivity:**Types of chemical bonds, comparison between ionic and covalent bonds, polarizability (Fajan's Rule), shapes of molecules, Lewis dot structure, Sidgwick, Powell Theory, basic VSEPR theory for AB_n type molecules with and without lone pair of electrons, isoelectronic principles, applications and limitations of VSEPR theory.	**7**
2.2	**Oxidation Reduction Chemistry:** Definition of Oxidation, Reduction and Redox reactions (with reference to addition or removal of H_2 or O_2 and electronic concept) oxidizing and reducing reagents. Oxidation number and rules for assigning oxidation number (Numericals expected). Balancing redox equations using ion electron method and oxidation number method. (Numericals expected)	**8**
III	**ORGANIC CHEMISTRY - Stereochemistry II:**	
3.1	**Cycloalkanes and Conformational analysis:** Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy.	**5**
3.2	**Aromatic Hydrocarbons:** Criteria for aromaticity including Hückel's rule, anti-aromaticity, aromatic character of arenes, cyclic carbocations/carbanions (examples using C1-C7 atoms) and heterocyclic compounds (examples with one hetero atom-O,N, S). Resonance energy, characteristics of aromatics compounds,	**10**
3.3	**Electrophilic aromatic substitution**-general mechanism halogenation, nitration, sulphonation and Friedel-Craft alkylation/acylation. Directing effects of substituents in mono substituted benzene.	
	REFERENCES: **Unit I:Physical Chemistry** Physical chemistry by McQuarrie (ISBN no.1891389505) Further Reading Physical Chemistry by Peter Atkins, Julio de Paula and James Keeler (ISBN; 9780198769866) **Unit II : Inorganic** Concise Inorganic Chemistry by J.D.Lee(ISBN 13:978-8126575547) Further reading: Inorganic Chemistry by D F Shriver and Peter Atkins **Unit III: Organic Chemistry** Organic Chemistry by Graham Solomons, Craig Fryhle(ISBN;9814-12-613-6)	

	Further reading Organic Chemistry by Jonathan, Clayden,Greeves Warren (ISBN:13) oxford-198503466 Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013	

PRACTICALS

Semester I Course Code: SBSCHEP1

COURSE OBJECTIVES:

CO 1	To prepare standard solutions for volumetric analysis
CO 2	To learn to carry out chemical kinetics in the laboratory
CO 3	To introduce volumetric and gravimetric methods of analysis
CO 4	To understand steps in characterization of organic compounds

COURSE LEARNING OUTCOMES : The learner will be able to

CLO 1	Prepare standard solutions of exact normality
CLO 2	Perform chemical kinetics and predict order of reaction from the data
CLO 3	Carry out analysis using volumetric and gravimetric methods
CLO 4	Characterize organic compounds using microscale technique

Unit I	**Physical Chemistry:** 1. To prepare 0.1 N succinic acid and standardize the NaOH of two different

	concentrations. 2. To determine enthalpy of dissolution of salt (like KNO_3) 3.To determine the rate constant for the hydrolysis of ester using HCl as catalyst. 4. To determine the rate constant for the saponification reaction between ethyl acetate and NaOH
Unit II	**Inorganic Chemistry:** .1. Commercial analysis of a) Mineral acid b) Organic acid 2. Titration using double indicator: analysis of solution of Na_2CO_3 and $NaHCO_3$. 3. Gravimetric analysis a) To determine the percentage purity of sample of $BaSO_4$ containing NH_4Cl b) To determine the percentage purity of ZnO containing $ZnCO_3$
Unit III	**Organic Chemistry:** **Characterization of organic compound containing C, H, (O), N, S, X elements.** (minimum 8 compounds)

Semester II Course Code: SBSCHEP2

COURSE OBJECTIVES:

CO 1	To learn the use of pH meter and colorimeter
CO 2	To learn the standardization of commercial samples of acids and bases
CO 3	To carry out qualitative analysis of inorganic salts
CO 4	To study the use of chromatography as a tool of separation and identification
CO 5	To learn to recrystallise organic solids

COURSE LEARNING OUTCOMES : Learner will be able to

CLO 1	Use pH meter and colorimeter for analysis of compounds
CLO 2	Successfully standardize commercial samples of acids and bases
CLO 3	Analyze and identify ions of mixture of inorganic salts using semi micro technique
CLO 4	Carry out TLC of mixture of organic compounds
CLO 5	Be able to purify organic solids by using suitable recrystallization solvents

Unit I	**Physical Chemistry: .** To determine dissociation constant of weak acid (Ka) using Henderson's equation and the method of incomplete titration pH metrically. 2. To verify Beer-Lambert's law, using the KMnO4 solution by colorimetric method. 3. To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved. 4. To standardize commercial samples of NaOH using Potassium Hydrogen Phthalate and to write material safety data of the chemicals involved.
Unit II	**Inorganic Chemistry** **1. Qualitative analysis: (at least 4 mixtures to be analyzed)** Semi-micro inorganic qualitative analysis of a sample containing two cations and two anions. Cations (from amongst): Pb^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Cu^{2+}, Fe^{2+}, Ni^{2+}, Mn^{2+} ,Mg^{2+}, Al^{3+} ,Cr^{3+}, K^{+},NH^{4+} Anions (From amongst): CO_3^{2-}, S^{2-} ,SO_3^{2-},NO_2^{-}, NO_3^{-},Cl^{-}, Br^{-}, I^{-}, SO_4^{2-}, PO_4^{3-} (Scheme of analysis to include sulphide scheme) **2. Redox Titration:** To determine the percentage of copper(II) present in a given sample by titration against a standard aqueous solution of sodium thiosulfate (iodometry titration)

Unit III	**Organic Chemistry** 1. Purification of any three organic compounds by recrystallization selecting suitable solvent. a) Solvent for recrystallization. b) Mass and the melting points of purified compound. 2. Chromatography Separation of a mixture of o-and p-nitrophenols by thin layer chromatography (TLC)
	Reference books: 1. Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009. 2. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., 3. Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996

FYBSc PAPER PATTERN
SEMESTER END EXAM (75 MARKS)

ASSESSMENT DETAILS (all the theory papers)

Internal Assessment (25 marks)
Part 1: Test or assignment (**20 Marks**)

Part 2: Attendance **– 05 marks**

SEE:

Q1 Unit I : Answer any four of the following. (4 out of 6) [20 marks]
Q2 Unit II : Answer any four of the following. (4 out of 6) [20 marks]
Q3 Unit III : Answer any four of the following. (4 out of 6) [20 marks]

Q4 A) Unit I :Do as Directed. Objective type (5 out of 7) [5 marks]
B) Unit II :Do as Directed. Objective type (5 out of 7) [5 marks]
C) Unit III :Do as Directed. Objective type (5 out of 7) [5 marks]

PRACTICAL ASSESSMENT

- The total marks of the practical = 150.
- The exam will be conducted in four sessions. Each session will have an experiment from each paper (50 marks x 3 = 150 marks)
- Attendance in all sessions is compulsory.
- The students are allowed to write the paper if the attendance for practical is more than 75%
- To appear in the practical exam, students must bring a certified journal.

****