

Academic Council Meeting No. and Date : 8 / September 04, 2023

Agenda Number : 2 Resolution Number : 34, 35 / 2.2, 2.23



**Vidya Prasarak Mandal's
B. N. Bandodkar College of
Science (Autonomous),
Thane**



**Syllabus for
Programme: Bachelor of Science
Specific Programme: Chemistry
Level 4.5**

CHOICE BASED GRADING SYSTEM

[F.Y.B.Sc. (Chemistry)]

Initiated in Academic year 1969-1970	Revised under NEP Academic year 2023 - 2024
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Preamble

The B.Sc. (Chemistry) programme is aimed to make the students employable and impart industry oriented training. The main objectives of the course are:

- To develop an aptitude to engage in continuing professional development.
- To work effectively as a part of a team to achieve a common stated goal.
- To be capable of managing complex chemical projects with consideration of the human, financial and environmental factors.
- To think analytically, creatively and critically in developing robust, extensible and highly maintainable technological solutions to simple and complex problems.
- To apply their knowledge and skills to be employed and excel in chemical industrial work.
- To communicate effectively with a range of audiences both technical and non-technical.

The syllabus is aimed to achieve the objectives. The syllabus spanning three years covers the industry relevant courses. The students will be ready for the jobs available in different fields like:

- History of Indian chemical science
- Introduction to physical concepts use for the chemical systems
- Study of thermodynamics, chemical kinetics, molecular spectroscopy, solid state, etc.
- Detailed study of periodic table
- Introduction to aliphatic and aromatic compounds
- Study of stereochemistry
- Introduction to analytical chemistry
- Study of safety precaution use in chemical laboratory
- Be skillful in handling various glassware and instruments

BOS Chairperson: Prof. Dr. Anita.S.Goswami-Giri

Eligibility:

Passed 12th standard (HSC) of Maharashtra State Board / CBSE / ICSE board with Mathematics as one of the subject.

Duration : 3 years (level 4.5)

Mode of Conduct:

Laboratory practicals / Offline lectures / Online lectures

Eligibility For certificate if exit at level 4.5**Program Outcome**

Student graduating with the Degree BSc Chemistry should be able to:

- Understand fundamental concepts in Physical, Inorganic, Organic, Analytical Chemistry and also all other allied subject areas.
- Students should be able to characterize, identify and separate components of organic, inorganic and also able to analyze them by making use of instrumental methods learned.
- Develop critical thinking ability by way of solving problems using basic chemistry knowledge.

Program Specific Outcome

- Study of structure, properties, reaction and application of chemical systems.
- Study of safety precaution use in chemical laboratory.
- Select and apply current techniques, skills, and tools necessary in chemical laboratory.
- Study of basics of Physical chemistry, Inorganic chemistry, Organic chemistry and Analytical chemistry.

Pedagogy:

- \$ Assignment Desk work, internal tests, Assignments, Quiz, ppt presentation You tube videos, referencing , MOOC, Problem solving, Project work, Industrial Visit, internship etc Pedagogy for student engagement is predominantly lectures. However, other pedagogies enhancing better student engagement to be recommended for each course. The list includes active learning/ course projects/ problem or project based learning/ case studies/self-study like seminar, term paper or MOOC
- \$ Every course needs to include assessment for higher order thinking skills (Applying/ Analyzing/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for learning)
- **Assessment: Weightage for assessments (in percentage)**

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	40 %	60 %
Practical	-	100 %
Experimental learning	-	100 %
Visits	-	100 %

BOS Chairperson: Prof. Dr. A. S. Goswami-Giri

VPM's B. N. Bandodkar College of Science (Autonomous), Thane.
COs and Mapping of COs with POs.
DEPARTMENT OF CHEMISTRY
(F. Y. B. Sc)

Subject: Chemistry									
Course Name: Chemistry Major 1 (Fundamental in Chemistry 1)									
Course Code: 23BUCH1T01									
	Course Outcome	Level		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	Explain rate laws for various order reactions and outline the properties of liquid states. (33%)	2	CO 1	1	0	0	0	0	0
CO 2	Classify elements using the periodic table. (16%)	2	CO 2	1	0	0	0	0	0
CO 3	Summarize the basic properties of atoms. (16%)	2	CO 3	1	0	0	0	0	0
CO 4	Understand IUPAC nomenclature, bonding, and structure of organic compounds. (33%)	2	CO 4	1	1	0	0	0	0

Subject: Chemistry									
Course Name: Chemistry Major 2 (Fundamental in Chemistry 2)									
Course Code: 23BUCH1T02									
	Course Outcome	Level		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	Understand and apply laws of thermochemistry. (33%)	2	CO 1	1	0	0	0	0	0
CO 2	Understand the properties and trends of main group elements. (16%)	2	CO 2	1	0	0	0	0	0
CO 3	Outline bonding properties of main group elements. (16%)	2	CO 3	1	0	0	0	0	0
CO 4	Explain the different projection formulae with their interconversion and illustrate different types of isomerism. (33%)	2	CO 4	0	1	0	0	0	0

Subject: Chemistry									
Course Name: Chemistry Minor 1 (Fundamental in Chemistry 1)									
Course Code: 23BUCH1T03									
	Course Outcome	Level		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	Explain rate laws for various order reactions and outline the properties of liquid states. (33%)	2	CO 1	1	0	0	0	0	0
CO 2	Classify elements using the periodic table. (16%)	2	CO 2	1	0	0	0	0	0
CO 3	Summarize the basic properties of atoms. (16%)	2	CO 3	1	0	0	0	0	0
CO 4	Understand IUPAC nomenclature, bonding, and structure of organic compounds. (33%)	2	CO 4	1	1	0	0	0	0

Subject: Chemistry									
Course Name: Chemistry Minor 2 (Fundamental in Chemistry 2)									
Course Code: 23BUCH1T04									
	Course Outcome	Level		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	Understand and apply laws of thermochemistry. (33%)	2	CO 1	1	0	0	0	0	0
CO 2	Understand the properties and trends of main group elements. (16%)	2	CO 2	1	0	0	0	0	0
CO 3	Outline bonding properties of main group elements. (16%)	2	CO 3	1	0	0	0	0	0
CO 4	Explain the different projection formulae with their interconversion and illustrate different types of isomerism. (33%)	2	CO 4	0	1	0	0	0	0

Subject: Chemistry									
Course Name: Generic-Indian Pioneers in Chemical Sciences and Chemistry in Everyday Life									
Course Code: 23BUCH1T05									
	Course Outcome	Level		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	Outline the general history of Indian scientists in Chemical Sciences. (25%)	2	CO 1	1	0	0	0	0	0
CO 2	Summarize the contributions of significant Indian scientists in chemical sciences and understand their field of research. (25%)	2	CO 2	1	0	0	0	0	0
CO 3	Explain the basics of food chemistry. (33%)	2	CO 3	1	0	0	0	0	0
CO 4	Summarize the methods for detecting adulterants in milk. (16%)	2	CO 4	0	0	0	0	0	1

Subject: Chemistry									
Course Name: SEC-Preparation of Standard Solutions and reagents									
Course Code: 23BU1SEC02									
	Course Outcome	Level		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	Apply quality control procedures for laboratory settings. (20%)	3	CO 1	1	0	0	0	1	0
CO 2	Understand various concentration terms. (20%)	2	CO 2	1	0	0	0	1	0
CO 3	Outline the principles and importance of standard solutions. (20%)	2	CO 3	1	0	0	0	1	0
CO 4	Understand principles, types of titrimetric analysis, and theory of indicators. (40%)	2	CO 4	2	0	0	0	2	0

Subject: Chemistry									
Course Name: Chemistry Practical (Major) (Chemistry Practical based on 23BUCH1T01 & 23BUCH1T02)									
Course Code: 23BUCH1P01									
	Course Outcome	Level		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	Estimate the unknown concentration with the help of various titrimetric analysis. (33%)	5	CO 1	1	0	0	0	1	0
CO 2	Understand principles, and techniques of gravimetric analysis and perform analysis of commercial samples. (33%)	2	CO 2	1	0	0	0	1	0
CO 3	Understand the recrystallization method. (16%)	2	CO 3	1	0	0	0	1	0
CO 4	Illustrate Thin Layer Chromatography method for separation of organic compounds. (16%)	2	CO 4	1	0	0	0	1	0

Subject: Chemistry									
Course Name: Chemistry Practical (Minor) (Chemistry Practical based on 23BUCH1T03 & 23BUCH1T04)									
Course Code: 23BUCH1P02									
	Course Outcome	Level		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	Estimate the unknown concentration with the help of various titrimetric analysis. (33%)	5	CO 1	1	0	0	0	1	0
CO 2	Understand principles, and techniques of gravimetric analysis and perform analysis of commercial samples. (33%)	2	CO 2	1	0	0	0	1	0
CO 3	Understand the recrystallization method. (16%)	2	CO 3	1	0	0	0	1	0
CO 4	Demonstrate Thin Layer Chromatography technique for separation of organic compounds. (16%)	2	CO 4	1	0	0	0	1	0

VPM's B.N.Bandodkar College of Science (Autonomous), Thane
F.Y.B.Sc. (Chemistry)
Structure of Programme

Semester 1: Major			
Course Code	Course Title	No. of lectures In hrs	Credits
23BUCH1T01	Major 1 (Fundamental in Chemistry 1)	30	2
23BUCH1T02	Major 2 (Fundamental in Chemistry 2)	30	2
23BUCH1P01	Chemistry Practicals	60	2
23BU1SEC02	SEC-Preparation of Standard Solutions and reagents	45	2
Total		165	8
Semester 1: Minor			
Course Code	Course Title	No. of lectures In hrs	Credits
23BUCH1T03	Minor 1 (Fundamental in Chemistry 1)	30	2
23BUCH1T04	Minor 2 (Fundamental in Chemistry 2)	30	2
23BUCH1P02	Chemistry Practicals	60	2
Total		120	6
Semester 1: Generic			
23BUCH1T05	Chemistry -I (Generic-1) Indian Pioneers in Chemical Sciences and Chemistry in Everyday Life	30	2
Total		30	2
Semester 1			
Optional Electives -Interdisciplinary Sciences			
23BUID1T01	Soft skills and personality development-I	30	2
Total		30	2
Semester 1 - (AEC)			
23BUEN1T01	Basic English Learning course	30	2
Total		30	2
Semester 1 - Indian Knowledge System			
23BUIK1T01	An Ancient Indian Social Structure-I	30	2

Total	30	2
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Semester 2: Major			
Course Code	Course Title	No. of lectures In hrs	Credits
23BUCH2T01	Major 1	30	2
23BUCH2T02	Major 2	30	2
23BUCH2P01	Chemistry Practicals	60	2
23BU2SEC02	SEC	45	2
Total		165	8
Semester 2: Minor			
Course Code	Course Title	No. of lectures In hrs	Credits
23BUCH2T03	Minor 1	30	2
23BUCH2T04	Minor 2	30	2
23BUCH2P02	Chemistry Practicals	60	2
Total		120	6
Semester 2: Generic			
23BUCH2T05	Chemistry -I (Generic-2)	30	2
Total		30	2
Semester 2			
Optional electives Interdisciplinary sciences			
23BUID2T01	Soft skills and personality development-II	30	2
Total		30	2
Semester 2 (AEC)			
23BUEN2T01	Scientific <i>English Writing</i>	30	2
Total		30	2
Semester 2- Indian Knowledge System			
23BUIK2T01	An Ancient Indian Social Structure-II	30	2

<i>Total</i>	30	2
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Note: AEC, IKS, Open elective syllabus view separately.

SEMESTER-I

Major

Semester I: Major

Course Code 23BUCH1T01	Course Title Major 1	Credits 2	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to <ul style="list-style-type: none"> Provides general knowledge for the determination of the sequence of elementary reactions and its mechanism. Study of properties and applications of liquid state Classification of elements in periodic table. Basics of Organic Chemistry. Study of basics of atomic structure. 			
Unit I :	<p>1.1 Chemical Kinetics: (5L) 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)</p> <p>1.2 Liquid State: (5L) 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 viscometer (Numericals expected) Refractive index: Introduction, 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</p> <p>1.3. Periodic Table and periodicity : (5L) 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 (Numerical problems expected, wherever applicable.)</p>	15	
Unit II :	<p>2.1) Hydrogenic atoms (5L) 1. Simple principles of quantum mechanics;</p>	15	

	<p>2. i) Atomic orbitals ii) Shells, subshells and orbitals</p> <p>3. Many Electron Atoms i) Penetration and shielding ii) Effective nuclear charge</p> <p>4. Aufbau principle</p> <p>2.2) Basics of Organic Chemistry (10L) 2.2.1. Classification and Nomenclature of Organic Compounds: 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.</p> <p>2.2.2 Bonding and Structure of organic compounds: Hybridization: sp^3, sp^2, sp hybridization of carbon and nitrogen; sp^3 and sp^2 hybridizations of oxygen in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide, amine and amide)</p>		
Course Code 23BUCH1T02	Course Title Major 2	Credits 2	No. of lectures
<p>Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to</p> <ul style="list-style-type: none">• Understand the various physical laws and rules which applied for chemical system• Study of properties and applications of thermodynamics etc.• Study inorganic compounds• Basics of stereochemistry			
Unit I :	<p>1.1 Chemical Thermodynamics 1</p> <p>Thermodynamic terms: System, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state functions and path functions, zeroth law of thermodynamics</p> <p>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)</p> <p>1.2 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</p>	15	

	<p>thermochemical data, Kirchhoff's equation (Numericals expected).</p> <p>1.3 Comparative chemistry of Main Group Elements</p> <p>Metallic and non-metallic nature, oxidation states, electronegativity, anomalous behaviour of second period elements, allotropy, catenation, diagonal relationship.</p>	
Unit II :	<p>2.1 Comparative chemistry of Main Group Elements</p> <p>Comparative chemistry of carbides, nitrides, oxides and hydroxides of group I and group II elements. Some important compounds- NaHCO_3, Na_2CO_3.</p> <p>2.2 Stereochemistry I:</p> <p>Fischer Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3 dichlorobutane) and their interconversions;</p> <p>Geometrical isomerism in alkene and cycloalkanes: cis–trans and syn-anti isomerism E/Z notations with C.I.P rules.</p> <p>Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Distereoisomers, meso structures, racemic mixture and resolution (methods of resolution not expected). Relative and absolute configuration: D/L and R/S designations.</p>	15

SEMESTER-I

Minor

Semester I: Minor

Course Code 23BUCH1T03	Course Title Minor 1	Credits 2	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to			
<ul style="list-style-type: none">• Provides general knowledge for the determination of the sequence of elementary reactions and its mechanism.• Study of properties and applications of liquid state• Classification of elements in periodic table.• Basics of Organic Chemistry.• Study of basics of atomic structure.			
Unit I :	1.1 Chemical Kinetics: (5L) 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: (5L) 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 viscometer (Numericals expected) Refractive index: Introduction, 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 1.3. Periodic Table and periodicity : (5L) 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 (Numerical problems expected, wherever applicable.)	15	
	Unit II :		2.1) Hydrogenic atoms (5L)

	<p>1. Simple principles of quantum mechanics; 2. i) Atomic orbitals ii) Shells, subshells and orbitals 3. Many Electron Atoms i) Penetration and shielding ii) Effective nuclear charge 4. Aufbau principle</p> <p>2.2) Basics of Organic Chemistry (10L) 2.2.1. Classification and Nomenclature of Organic Compounds: 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.</p> <p>2.2.2 Bonding and Structure of organic compounds: Hybridization: sp^3, sp^2, sp hybridization of carbon and nitrogen; sp^3 and sp^2 hybridizations of oxygen in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide, amine and amide)</p>		
Course Code 23BUCH1T04	Course Title Minor 2	Credits 2	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to			
<ul style="list-style-type: none">• Understand the various physical laws and rules which applied for chemical system• Study of properties and applications of thermodynamics etc.• Study inorganic compounds• Basics of stereochemistry			
Unit I :	<p>1.1 Chemical Thermodynamics 1</p> <p>Thermodynamic terms: System, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state functions and path functions, zeroth law of thermodynamics</p> <p>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)</p> <p>1.2 Thermochemistry: Heats of reactions, standard states, enthalpy of formation of molecules, enthalpy of combustion and its applications, calculation of bond energy, bond</p>	15	

	<p>dissociation energy and resonance energy from thermochemical data, Kirchhoff's equation (Numericals expected).</p> <p>1.3 Comparative chemistry of Main Group Elements</p> <p>Metallic and non-metallic nature, oxidation states, electronegativity, anomalous behaviour of second period elements, allotropy, catenation, diagonal relationship.</p>	
Unit II :	<p>2.1 Comparative chemistry of Main Group Elements Comparative chemistry of carbides, nitrides, oxides and hydroxides of group I and group II elements. Some important compounds- NaHCO_3, Na_2CO_3.</p> <p>2.2 Stereochemistry I: Fischer Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3 dichlorobutane) and their interconversions;</p> <p>Geometrical isomerism in alkene and cycloalkanes: cis-trans and syn-anti isomerism E/Z notations with C.I.P rules.</p> <p>Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Distereoisomers, meso structures, racemic mixture and resolution (methods of resolution not expected). Relative and absolute configuration: D/L and R/S designations.</p>	15

References

Semester 1					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Physical Chemistry	I. N. Levine	Tata Mc Graw Hill	6 th	2010
2.	Molecular Thermodynamics	D. A. McQuarrie	Viva Books Pvt. Ltd., New Delhi		2004
3.	Physical Chemistry	P.W. Atkins	Oxford University Press	10 th	2014
4.	Concise Inorganic Chemistry	J. D. Lee	ELBS		1991
5.	Stereochemistry Conformation and Mechanism	Kalsi, P. S.	New Age International	-	2005
6.	Organic Chemistry	R. T. Morrison	Dorling Kindersley	-	2011

			(India) Pvt Ltd. (Pearson Education)		
7.	Stereochemistry of Organic Compounds Principles and applications	D. Nasipuri	New Age International Publishers	2 nd	2012

Semester I

Course Code 23BUCH1T05	Course Title Generic	Credits 2	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to <ul style="list-style-type: none">History of Indian chemical scienceChemistry in Every Day Life (Food chemistry)			
Unit I :	HISTORY OF SCIENCE : General history of Chemical science Indian Pioneers in Chemical sciences : 1. Prof. C. N. R. Rao: Area of research: Prof. C. N. R. Rao is a leading Indian scientist in the field of solid state and materials chemistry. His major area of research comprises transition metal oxides and other extended inorganic solids, inorganic- organic hybrid materials, nanomaterials and generation of hydrogen by photocatalysis. 2. Acharya P. C. Ray: Area of research: Acharya P. C. Ray established the first modern research in Chemistry and is regarded as the father of chemical science in India. He published around 150 research articles during his lifetime. He discovered the stable compound mercurous nitrite in 1896 and established Bengal chemical and pharmaceutical works Ltd, India's first pharmaceutical company in 1901. 3. Prof. H. J. Arniker: Area of research: Prof. H. J. Arniker was worked in the field of Radiochemistry and Allied sciences. He was applied Neutron activation analysis in the various fields of chemical science. 4. Har Govind Khurana: Area of research: The researcher shared the 1968 Nobel prize for Physiology or Medicine with Marshall W. Nirnberg and Robert W. Holley for research that showed how the order of nucleotides in nucleic acids, which carry genetic code of the cell, control the cell's synthesis of proteins. 5. Dr. Yusuf Khwaja Hamid: Area of research: Dr. Yusuf Khwaja Hamid is a Polish born Indian scientist, the chairman of Cipla, a generic pharmaceuticals company founded by his father Kwaja Abdul Hamied in 1935. He is also an elected fellow of the Indian National Science Academy. 6. Dr. Asima Chatterjee: Area of research: Dr. Asima	15	

	<p>Chatterjee was an Indian organic chemist noted for her work in the fields of organic chemistry and phytomedicine. Her most notable work includes research on vinca alkaloids, the development of anti-epileptic drugs and development of anti-malarial drugs.</p> <p>7. Prof. S. R. Gadre: Area of research: Prof. S. R. Gadre is an Indian scientist working in computational quantum and theoretical chemistry. He has authored authors over 200 publications mostly in highly impact factors.</p>	
Unit II :	<p>Chemistry in Every Day Life Introduction to food chemistry</p> <ol style="list-style-type: none"> 1. Food processing and preservation: Introduction, need, chemical methods, action of chemicals (Sulphur dioxide, boric acid, sodium benzoate, acetic acid, sodium chloride and sugar) and pH control 2. Physical methods (Pasteurization: LTLT, HSST and Irradiation) 3. Detection of adulterants in Milk: Sugar, Starch, H₂O₂, Formalin, Urea, Ammonium sulphate, Detergent, Borax 	15

References

Semester 1					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Analysis of food and Beverages	George Charalanbous	Academic press	1 st	1978
2.	An Advance Dairy chemistry	P. F. Fox, P. L. H. McSweeney	Springer	Volume 3	1997
3.	Food Analysis: Theory and practice	Yeshajahu Pomeranz, Clifton E. Meloan	Springer	3 rd	1978
4.	Food Analysis	Edited by S. Suzanne Nielsen	Springer	5 th	2017
5.	Government of India publications of food drug cosmetic act and rules.	-	-	-	-

Semester I

Course Code 23BU1SEC02	Course Title SEC	Credits 2	No. of lectures
Course outcome: <ul style="list-style-type: none"> • To brand students independent in constructing curves/plots using which evaluation of exact amount or strength of selected component present in unknown sample. • To impart skills which they require while seeking jobs and to sharpen their knowledge and need to understand concepts and issues at their workplace 			
UNIT NO	COURSE CONTENTS	NO. OF LECTURE S in hrs.	NO. OF PRACTICALS in hrs.
I	Introduction Accuracy, precision, calibration of glass wares and its importance	3	6
II	Chemical Calculations Normality, Molarity, Molality, Formality, ppm, ppb, Millimoles, Milliequivalents, Mole fraction, Weight ratio, Volume ratio and weight to volume ratio.	3	6
III	Standard solutions Concept of Primary standard solution and Secondary standard solution.	3	6
IV	Titrimetric analysis Types of reactions and construction of titration curves.	3	6
V	Indicators Theory of indicators, Preparation of indicators, Types of indicators, Mechanism of indicator action	3	6
	Total Period = 45	15	30
	Credit = 02		

Practicals: Major

Course Code 23BUCH1P01	Course Title Chemistry Practical	Credits 2	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to			
<ul style="list-style-type: none">• Be skillful in handling various glassware and instruments.• Actively participate in chemical laboratories.• Study of commercial analysis of various organic and inorganic compounds.• Learned basics of chemical analysis.			
<ol style="list-style-type: none">1. To prepare 0.1 N succinic acid and standardize the NaOH of two different concentrations2. To determine the rate constant for the hydrolysis of ester using HCl as catalyst-I (Experiment)3. To determine the rate constant for the hydrolysis of ester using HCl as catalyst- II (Calculation, graph and results)4. To determine enthalpy of dissolution of salt (like KNO3)			60
Commercial analysis of---- 5. Mineral acid 6. Organic acid 7. Salt of weak acid and strong base. 8. Titration using double indicator: analysis of solution of Na2CO3 and NaHCO3. Gravimetric analysis 9. To determine the percent purity of sample of BaSO4 containing NH4Cl 10. To determine the percent purity of ZnO containing ZnCO3.			
Purification of any four organic compounds by recrystallization selecting suitable solvent. (Provide 1g.). Learners are expected to report <ol style="list-style-type: none">a) Solvent for recrystallization.b) Mass and the melting points of purified compound. <ol style="list-style-type: none">11. Sample-112. Sample-213. Sample-314. Sample-4 (Learners should calibrate thermometer before determining melting point.)15. Chromatography Separation of a mixture of o-and p-nitrophenols by thin layer chromatography (TLC)			

Practicals: Minor

Course Code 23BUCH1P02	Course Title Chemistry Practical	Credits 2	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to			
<ul style="list-style-type: none">• Be skillful in handling various glassware and instruments.• Actively participate in chemical laboratories.• Study of commercial analysis of various organic and inorganic compounds.• Learned basics of chemical analysis.			
<ol style="list-style-type: none">1. To prepare 0.1 N succinic acid and standardize the NaOH of two different concentrations2. To determine the rate constant for the hydrolysis of ester using HCl as catalyst-I (Experiment)3. To determine the rate constant for the hydrolysis of ester using HCl as catalyst- II (Calculation, graph and results)4. To determine enthalpy of dissolution of salt (like KNO3)			60
Commercial analysis of- 5. Mineral acid 6. Organic acid 7. Salt of weak acid and strong base. 8. Titration using double indicator: analysis of solution of Na2CO3 and NaHCO3.			
Gravimetric analysis- 9. To determine the percent purity of sample of BaSO4 containing NH4Cl 10. To determine the percent purity of ZnO containing ZnCO3.			
Purification of any four organic compounds by recrystallization selecting suitable solvent. (Provide 1g.). Learners are expected to report a) Solvent for recrystallization. b) Mass and the melting points of purified compound.			
<ol style="list-style-type: none">11. Sample-112. Sample-213. Sample-314. Sample-4 (Learners should calibrate thermometer before determining melting point.) 15. Chromatography Separation of a mixture of o-and p-nitrophenols by thin layer chromatography (TLC)			

References for practical

Semester 1					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Senior Practical Physical Chemistry	B. D. Khosla	-	-	2011
2.	Vogel's <i>Quantitative Chemical Analysis</i>	J. Mendham	Pearson	6th	2009
3.	Practical Organic Chemistry	F.G. Mann,	Pearson Education	-	2009
4.	Textbook of Practical Organic Chemistry	A. I. Vogel	Prentice-Hall	5th	1996

SEMESTER-II

Major

Semester 2: Major

Course Code 23BUCH2T01	Course Title Major 1	Credits 2	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to <ul style="list-style-type: none"> • Study of thermodynamic parameters of chemical system. • Study of acid-base theory. • Introduction of analytical chemistry. • Learned chemistry of aliphatic compounds. 			
Unit I :	1.1 Gaseous State: (10L) 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, Joule- Thomson effect: qualitative discussion and experimentation, inversion temperature. (Numericals expected) Statement of second law of thermodynamics, concepts of entropy and free energy, spontaneity and physical significance of free energy. 1.2 Acid Base Theories: (5L) Arrhenius, Lowry- Bronsted, Lewis, Solvent – Solute concept of acids and bases, Hard and Soft acids and bases.		15
Unit II :	2.1 Concept of Qualitative Analysis: (5L) Precipitation equilibria, effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations and numerical problems expected.)		15
	2 Chemistry of Aliphatic Hydrocarbons 2.1 Carbon-Carbon pi bonds: (10L) 2.1.1 Formation of alkenes and alkynes by elimination reactions: Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. 2.1.2 Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction(catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2-and 1, 4- addition		15

	reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination using N-bromosuccinimide and mechanism, e.g. propene, 1-butene, toluene, ethylbenzene.	
Course Code 23BUCH2T02	Course Title Major 2	Credits 2
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to <ul style="list-style-type: none"> • Study of ionic equilibria, molecular thermodynamics, etc. • Introduction of redox reaction • Detail study of stereochemistry. • Brief overview of aromatic compounds. 		
Unit I :	1.1 Ionic Equilibria (5L) 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 (exact treatment for monoprotic acid) Buffers: Introduction, types of buffers, derivation of Henderson equation for acidic and basic buffers, buffer action, buffer capacity (Numericals expected) 1.2 Molecular Spectroscopy: (5L) Electromagnetic radiation, electromagnetic spectrum, Planck's equation, interaction of electromagnetic radiation with matter: Absorption, emission, scattering, fluorescence, electronic, vibrational and rotational transitions, Beer-Lambert's law (Numericals expected) 1.3 Chemical Bond and Reactivity: (5L) Types of chemical bond, 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.	15
Unit II :	2.1 Oxidation Reduction Chemistry: (5L) a) Reduction potentials b) Redox potentials: half reactions; balancing redox	15

	<p>equations.</p> <p>c) Redox stability in water</p> <p>i) Latimer and Frost Diagrams</p> <p>ii) pH dependence of redox potentials.</p> <p>d) Applications of redox chemistry</p> <p>Redox reagents in Volumetric analysis: a) I_2; b) $KMnO_4$</p> <p>2.2 Stereochemistry-II: Cycloalkanes and Conformational Analysis: (5L)</p> <p>Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy.</p> <p>2.3 Aromatic Hydrocarbons: (5L)</p> <p>Aromaticity: Hückel's rule anti-aromaticity, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft alkylation/acylation with their mechanism. Hammond's postulate, Directing effects of the groups.</p>	
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SEMESTER-II

Minor

Semester 2: Minor

Course Code 23BUCH2T03	Course Title Minor 1	Credits 2	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to <ul style="list-style-type: none"> • Study of thermodynamic parameters of chemical system. • Study of acid-base theory. • Introduction of analytical chemistry. • Learned chemistry of aliphatic compounds. 			
Unit I :	1.1 Gaseous State: (10L) 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, Joule- Thomson effect: qualitative discussion and experimentation, inversion temperature. (Numericals expected) Statement of second law of thermodynamics, concepts of entropy and free energy, spontaneity and physical significance of free energy. 1.2 Acid Base Theories: (5L) Arrhenius, Lowry- Bronsted, Lewis, Solvent – Solute concept of acids and bases, Hard and Soft acids and bases.		15
Unit II :	2.1 Concept of Qualitative Analysis: (5L) Precipitation equilibria, effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations and numerical problems expected.)		15
	3 Chemistry of Aliphatic Hydrocarbons 3.1 Carbon-Carbon pi bonds: (10L) 2.1.1 Formation of alkenes and alkynes by elimination reactions: Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. 2.1.2 Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction(catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2-and 1, 4- addition		15

	reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination using N-bromosuccinimide and mechanism, e.g. propene, 1-butene, toluene, ethylbenzene.	
Course Code 23BUCH2T04	Course Title Minor 2	Credits 2
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to <ul style="list-style-type: none"> • Study of ionic equilibria, molecular thermodynamics, etc. • Introduction of redox reaction • Detail study of stereochemistry. • Brief overview of aromatic compounds. 		
Unit I :	1.1 Ionic Equilibria (5L) 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 (exact treatment for monoprotic acid) Buffers: Introduction, types of buffers, derivation of Henderson equation for acidic and basic buffers, buffer action, buffer capacity (Numericals expected) 1.2 Molecular Spectroscopy: (5L) Electromagnetic radiation, electromagnetic spectrum, Planck's equation, interaction of electromagnetic radiation with matter: Absorption, emission, scattering, fluorescence, electronic, vibrational and rotational transitions, Beer-Lambert's law (Numericals expected) 1.4 Chemical Bond and Reactivity: (5L) Types of chemical bond, 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.	15
Unit II :	2.3 Oxidation Reduction Chemistry: (5L) a) Reduction potentials b) Redox potentials: half reactions; balancing redox equations.	15

	<p>c) Redox stability in water</p> <p>i) Latimer and Frost Diagrams</p> <p>ii) pH dependence of redox potentials.</p> <p>d) Applications of redox chemistry</p> <p>Redox reagents in Volumetric analysis: a) I₂; b) KMnO₄</p> <p>2.4 Stereochemistry-II: Cycloalkanes and Conformational Analysis: (5L)</p> <p>Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy.</p> <p>2.3 Aromatic Hydrocarbons: (5L)</p> <p>Aromaticity: Hückel's rule anti-aromaticity, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft alkylation/acylation with their mechanism. Hammond's postulate, Directing effects of the groups.</p>	
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References

Semester 2					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Physical Chemistry	I. N. Levine	Tata Mc Graw Hill	6 th	2010
2.	Molecular Thermodynamics	D. A. McQuarrie	Viva Books Pvt. Ltd., New Delhi		2004
3.	Physical Chemistry	P.W. Atkins	Oxford University Press	10 th	2014
4.	Concise Inorganic Chemistry	J. D. Lee	ELBS		1991
5.	Stereochemistry Conformation and Mechanism	Kalsi, P. S.	New Age International	-	2005
6.	Organic Chemistry	R. T. Morrison	Dorling Kindersley (India) Pvt Ltd. (Pearson Education)	-	2011
7.	Stereochemistry of Organic Compounds Principles and applications	D. Nasipuri	New Age International Publishers	2 nd	2012

Semester II

Course Code 23BU2SEC02		Course Title SEC		Credits 2	No. of lectur es
UNITNO	COURSE CONTENTS	NO. OF LECTURE S	NO. OF PRACTICALS in hrs.		
I.	Instrumental techniques				
II.	i. pH-meter Principle, instrumentation and application	2	4		
III.	ii. Conductometer Principle, instrumentation and application	2	4		
IV.	iii Potentiometer Principle, instrumentation and application	2	6		
V.	iv. Spectrophotometer Principle, instrumentation and application	4	8		
VI.	v. Flame Emission spectrophotometer Principle, instrumentation and application	5	8		
VII.	Total Period = 45	15	30		
	Credit = 02				

Semester II

Course Code 23BUCH2T05	Course Title Generic	Credits 2	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to <ul style="list-style-type: none"> Understand the Safety in Chemical Laboratory Study of Cosmetics and estimation of main constituents 			
Unit I :	1. Safety in Chemical Laboratory Basic concepts of Safety in Laboratories, Personal Protection Equipment (PPE), OSHA, Toxic Hazard (TH) classifications, Hazardous Chemical Processes (including process calorimetry / thermal build up concepts). 2. Quality Management System (QMS): Evolution and significance of Quality Management, types of quality standards for laboratories, total quality management (TQM), philosophy implementation of TQM (reference of Kaizen, Six Sigma approach & 5S), quality audits and quality reviews, responsibility of laboratory staff for quality and problems. 3. Accreditations: Accreditation of Laboratories, Introduction to ISO series, Indian Government Standards (ISI, Hallmark, Agmark) 4. Good Laboratory Practices (GLP) Principle, Objective, OECD guidelines, The US FDA 21CFR58, Klimisch score	15	
Unit II :	1. Cosmetics: Introduction and sensory properties 2. Study of cosmetic products: 2.1. Face powder: Composition, Estimation of calcium and magnesium by complexometric titration 2.2. Lipstick: Constituents, Ash analysis for water soluble salts: borates, carbonates and zinc oxide 2.3. Deodorants and Antiperspirants: Constituents, properties Estimation of zinc by gravimetry	15	

References:

Semester 2					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Safety and Hazards Management in Chemical Industries	M N Vyas	Atlantic Publisher	Ch:4, Ch:5 & Ch:19	2020
2.	Industrial Hygiene and Chemical Safety	M H Fulekar	IK International Pvt. Ltd.	Ch:9, Ch:11 & Ch:15	2006
3.	Quality Management	Donna C S Summers	Pearson	2 nd , Ch:3	2008
4.	Quality in the Analytical Laboratory	Elizabeth Pichard	Wiley India	Ch: 5, Ch: 6 & Ch: 7	1995
5.	ISO 9000 Quality Systems Handbook	David Hoyle	Butterworth-Heinemann publications	Fourth Edition, Chapter: 3 & 4	2001
6.	Quality in Totality: A Manager's Guide To TQM and ISO 9000	Parag Diwan	Deep & Deep Publications	1st Edition	2000
7	OECD Principles of Good Laboratory Practice (as revised in 1997)"	-	OECD Environmental Health and Safety Publications, OECD.	1 st	1998
8	A systematic approach for evaluating the quality of experimental toxicological and ecotoxicological data".	Klimisch, HJ; Andreae, M; Tillmann, U	REGULATORY TOXICOLOGY AND PHARMACOL OGY 25, 1–5 (1997) ARTICLE NO. RT961076	doi:10.1006 /rtph.1996.1 076. PMID 9056496.	1997

Practicals: Major

Course Code 23BUCH2P01	Course Title Chemistry Practical	Credits 1	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to <ul style="list-style-type: none"> • Be skillful in handling various glassware and instruments. • Introduction of instruments used in chemical laboratory • Actively participate in chemical laboratories • Study of characterization of organic compounds. 			
1.	Unit I: Physical Chemistry 1. To determine the rate constant for the saponification reaction between ethyl acetate and NaOH 2. To determine dissociation constant of weak acid (Ka) using Henderson's equation and the method of incomplete titration pHmetrically. 3. To verify Beer-Lambert's law, using KMnO ₄ solution by colorimetric method. 4. To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved.	30	
2.	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⁺ , Cd 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 ₃ ⁻ , I ⁻ , SO ₄ ²⁻ , PO ₄ ³⁻ (Scheme of analysis should avoid use of sulphide ion in any form for precipitation / separation of cations.) 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)		
3.	Unit III: Organic Chemistry Characterization of organic compound containing C, H, (O), N, S, X elements. (minimum 7 compounds)		

Practicals: Minor

Course Code 23BUCH2P02	Course Title Chemistry Practical	Credits 1	No. of lectures
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to <ul style="list-style-type: none"> • Be skillful in handling various glassware and instruments. • Introduction of instruments used in chemical laboratory • Actively participate in chemical laboratories • Study of characterization of organic compounds. 			
1.	Unit I: Physical Chemistry 1. To determine the rate constant for the saponification reaction between ethyl acetate and NaOH 2. To determine dissociation constant of weak acid (Ka) using Henderson's equation and the method of incomplete titration pHmetrically. 3. To verify Beer-Lambert's law, using KMnO ₄ solution by colorimetric method. 4. To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved.	30	
2.	Unit II: Inorganic Chemistry 2. 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⁺ , Cd 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 ₄ ²⁻ , NO ₂ ⁻ , NO ₃ ⁻ , Cl ⁻ , Br ⁻ , I ⁻ , SO ₄ ²⁻ , PO ₄ ³⁻ (Scheme of analysis should avoid use of sulphide ion in any form for precipitation / separation of cations.) 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)		
3.	Unit III: Organic Chemistry Characterization of organic compound containing C, H, (O), N, S, X elements. (minimum 7 compounds)		

References

Semester 2					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Senior Practical Physical Chemistry	B. D. Khosla	-	-	2011
2.	Vogel's <i>Quantitative Chemical Analysis</i>	J. Mendham	Pearson	6 th	2009
3.	Practical Organic Chemistry	F.G. Mann,	Pearson Education	-	2009
4.	Textbook of Practical Organic Chemistry	A. I. Vogel	Prentice-Hall	5 th	1996

Evaluation Scheme 20:30**Internals**

Attendance	Group discussion	Assignments	Leadership qualities	Total
05	05	05	05	20
OR Class test				
OR Certification of Swayam / NPTEL in concern course				

Theory Examination: Suggested Format of Question paper**Duration: 1.30 Hours****Total Marks : 30****All questions are compulsory**

Q.1	Attempt ANY TWO of the following		(10)
(A)	Unit 1		
(B)	Unit 1		
(C)	Unit 1		
(D)	Unit 1		
Q.2	Attempt ANY TWO of the following		(10)
(A)	Unit 2		
(B)	Unit 2		
(C)	Unit 2		
(D)	Unit 2		
Q.3	Answers the following (Attempt ANY TWO)		(10)
(A)	Fill in the blanks.		
	i)	Unit 1	
	ii)	Unit 1	
	iii)	Unit 2	
	iv)	Unit 2	
	v)	Unit 2	
(B)	Multiple choice questions.		
	i)	Unit 1	
	ii)	Unit 1	
	iii)	Unit 1	
	iv)	Unit 2	

	v)	Unit 2	
(C)	Match the following		
	i)	Unit 1	
	ii)	Unit 1	
	iii)	Unit 2	
	iv)	Unit 2	
	v)	Unit 2	
(D)	True and False		
	i)	Unit 1	
	ii)	Unit 1	
	iii)	Unit 1	
	iv)	Unit 2	
	v)	Unit 2	

Marks Distribution and Passing Criterion for Each Semester

Semester 1 and Semester 2: Major and SEC

Theory				
Course Code	Internal	Min marks for passing	Theory Examination	Min marks for passing
23BUCH1T01	20	08	30	12
23BUCH1T02	20	08	30	12
23BUCH1P01	-	-	50	20
23BU1SEC02	Internal and external Theory + Practical		Theory + Practical 50 marks	20

Semester 1 and Semester 2: Minor

Theory				
Course Code	Internal	Min marks for passing	Theory Examination	Min marks for passing
23BUCH1T03/23BUCH2T03	20	08	30	12
23BUCH1T04/23BUCH2T03	20	08	30	12
23BUCH1P02/23BUCH2T03	-	-	50	20

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Curriculum mapping for the Undergraduate Degree Programme F.Y.B.Sc Chemistry

	SEMESTER – I	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
Course Code	Major Course Title	EM	EN	SD	PE	GE	HV	ES
23BUCH1T01	Major 1	√	--	--	--	--	--	--
23BUCH1T02	Major 2	√	--	--	--	--	--	--
23BUCH1P01	Chemistry Practicals	√	--	√	--	--	--	--
23BU1SEC02	SEC	√	√	√	--	--	--	√
	Minor Course Title							
23BUCH1T03	Minor 1	√	--	--	--	--	--	--
23BUCH1T04	Minor 2	√	--	--	--	--	--	--
23BUCH1P02	Chemistry Practicals	√	--	√	--	--	--	√
Course Code	Generic - Course Title							
23BUCH1T05	Chemistry -I (Generic-1)	--	--	--	--	--	--	--
08	Total	07	01	03	00	00	00	02

	SEMESTER – II	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
Course Code	Major Course Title	EM	EN	SD	PE	GE	HV	ES
23BUCH2T01	Major 1	√	--	--	--	--	--	-
23BUCH2T02	Major 2	√	--	--	--	--	--	--
23BUCH2P01	Chemistry Practicals	√	--	√	--	--	--	--
23BU2SEC02	SEC	√	√	√	--	--	--	--
	Minor Course Title							
23BUCH2T03	Minor 1	√	--	--	--	--	--	--
23BUCH2T04	Minor 2	√	--	--	--	--	--	--
23BUCH2P02	Chemistry Practicals	√	--	√	--	--	--	√
Course Code	Generic - Course Title							
23BUCH2T05	Chemistry -I (Generic-2)	-	--	--	--	--	--	--
08	<i>Total</i>	07	01	03	00	00	00	01

Prof. Dr. A.S. Goswami
BOS Chairman & Head Dept. Of Chemistry