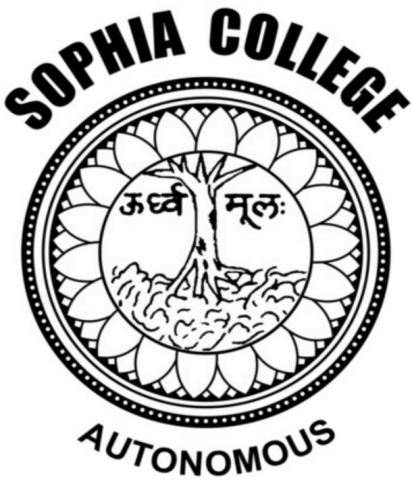


SOPHIA COLLEGE (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Programme: Science, Chemistry (Major/Minor)

F.Y.B.Sc.

Syllabus for the Academic Year 2023-2024

based on the National Education Policy 2020

Programme Outline: FYBSc DSC (SEMESTER I)

-

Course Code	Unit No	Name of the Unit	Credits
SCHE111MJ/MN	Unit 1 Physical Chemistry	1.1 Chemical Thermodynamics (10L)	3
		1.2 Chemical Kinetics (5L)	
	Unit 2 Inorganic Chemistry	2.1 Atomic structure (5L)	
		2.2 Periodic Table and periodicity (5L)	
		2.3 Concept of Qualitative Analysis (5L)	
	Unit 3 Organic Chemistry	3.1Classification and Nomenclature of Organic Compounds (5L)	
		3.2 Bonding and Structure of organic compounds: (4L)	
		3.3Fundamentals of organic reaction mechanism (6L)	
SCHE111MJP/ MNP		Chemistry Practicals	1

Programme Outline: FYBSc DSC (SEMESTER II)

Course Code	Unit No	Name of the Unit	Credits
SCHE122MJ/MN	Unit 1 Physical Chemistry	1.1 Ionic Equilibria (5L)	3
		1.2 Gaseous State (5L)	
		1.3 Chemical Equilibria (5L)	
	Unit 2 Inorganic Chemistry	2.1: Chemical Bond and Reactivity (8L)	
		2.2 Comparative Chemistry of Main Group Elements: (7L)	
	Unit 3 Organic Chemistry	3.1 Stereochemistry I (12L)	
		3.2 Introduction to aromaticity: (3L)	
SCHE122MJP/ MNP		Chemistry Practicals	1

Programme Outline: FYBSc (SEMESTER I)

VSC 1: Food Additives and food adulterants

Course Code	Unit No	Name of the Unit	Credits
SVSC101	Unit 1 Theory	1.1 Food groups [2L]	2
		1.2 Food Additives [4L]	
		1.3 Food Adulteration [6L]	
		1.4 Present law and regulations (wrt food adulteration and additives) [2L]	
		1.5 Consumer Protection [1L]	
	Unit 2 Practical	2.1. Detection of food groups	
		2.2. Qualitative Detection of food additives	
		2.3 Qualitative Detection of adulterants in food	
		2.4 Quantitative determination	
		2.5 Project work	

Programme Outline: FYBSc (SEMESTER I)

VSC 2 - Cosmeticology_

Course Code	Unit No	Name of the Unit	Credits
SVSC102	Unit 1 Theory	1.1 Basics of cosmetics	2
		1.2 Skin Products	
		1.3 Hair Products	
		1.4 Coloured products	
		1.5 Hygiene Products	
	Unit 2 Practical	2.1. Preparation Preparation of cosmetic formulation	
		2.2 Qualitative Analysis of cosmetic products	
		2.3. Assay of products	

Programme Outline: FYBSc (SEMESTER I)

IKS - Minerals and metals in ancient India

Course Code	Unit No	Name of the Unit	Credits
IKS105	Unit 1	1.1 Minerals and Metals in the Rigveda	

		1.2 Minerals and metals in the vedic literature	2
	Unit 2	2.1 Pre- Harappan Era	
		2.2 Project work	

Programme Outline: FYBSc (SEMESTER II)

SEC 1 - Journey of Metals: Ores to alloys

Course Code	Unit No	Name of the Unit	Credits
201	Unit 1 Theory	1.1 Introduction to ores [1L]	2
		1.2 Extractive techniques [2L]	
		1.3 Metallurgical process [2L]	
		1.4 Extraction of metals from their ores [4L]	
		1.5 Introduction to alloys [1L]	
		1.6 Chemical composition , methods of estimation and application of alloys [5L]	
	Unit 2 Practical	2.1Opening of ores and their analysis	
		2.2. Opening of alloys and their estimation	
		2.3 Estimation of the metal from synthetic samples of alloys	

Programme Outline: FYBSc (SEMESTER II)

SEC 2 - Universal solvent : Water

Course Code	Unit No	Name of the Unit	Credits
202	Unit 1 Theory	1.1 Introduction to ores [1L]	2
		1.2 Extractive techniques [2L]	
		1.3 Metallurgical process [2L]	
		1.4 Extraction of metals from their ores [4L]	
		1.5 Introduction to alloys [1L]	
		1.6 Chemical composition , methods of estimation and application of alloys [5L]	
	Unit 2 Practical	2.1Opening of ores and their analysis	
		2.2. Opening of alloys and their estimation	
		2.3 Estimation of the metal from synthetic samples of alloys	

Programme Outline: FYBSc (SEMESTER II)

OE - Serendipity: Discoveries triggered by chance

Course Code	Unit No	Name of the Unit	Credits
OE206	Unit 1	1.1 Discoveries in medicine	2
		1.2 Discoveries in food	
	Unit 2	2.1 Discoveries in cosmetics /chemicals	
		2.2 Discoveries in polymers	

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.

DEPARTMENT OF CHEMISTRY

COURSE DETAILS FOR MAJOR:

	SEMESTER 1		SEMESTER 2
TITLE	**Fundamentals of Chemistry -1**		**Fundamentals of Chemistry -2**
TYPE OF COURSE	**Discipline Specific Course (DSC)**		**Discipline Specific Course (DSC)**
CREDITS	**4 (3 Theory + 1 Practical)**		**4(3 Theory + 1 Practical)**

COURSE DETAILS FOR MINOR:

	SEMESTER 1		SEMESTER 2
TITLE	Fundamentals of Chemistry -1		Fundamentals of Chemistry -2
TYPE OF COURSE	Discipline Specific Course (DSC)		Discipline Specific Course (DSC)
CREDITS	4 (3 Theory + 1 Practical)		4(3 Theory + 1 Practical)

Programme: Science, Chemistry Major / Minor		Semester – 1	
Course Title: Fundamentals of Chemistry-1		Course Code: SCHE111MJ/MN	
Number of lectures per week: 1 Theory credit is 60 minute 1 Practical credit is 120 minutes		3 Theory + 1 Practical	
Total number of Hours in a Semester		45 + 30	
Credits		4 (3 theory +1 practical)	
Evaluation System	Summative Assessment	2 hours	50 marks
	Internal Assessment	--	50 marks
	Practical	-–	50 marks

COURSE OBJECTIVES:

CO 1	To understand the fundamental concepts of thermodynamics and relationship among thermodynamic parameters
CO 2	To understand the fundamental concepts of chemical kinetics.
CO 3	To clarify the basics of atomic structure and understand the shapes of orbital and assigning quantum numbers
CO 4	To correlate the chemical properties of elements with their position in the periodic

	table
CO 5	To understand the fundamental concepts of organic chemistry and its effect on acidity, basicity, reactivity of organic compounds.

COURSE LEARNING OBJECTIVES: The learner will be able to

CLO 1	Derive relationship between different thermodynamic variables and solve numericals based on data given
CLO 2	Interpret data obtained from various kinetic reactions and identify order of reaction
CLO 3	Explain the shapes of atomic orbital and assign quantum number
CLO 4	Capable of discerning the chemical properties of elements based on parameters with predictable trends across periods and groups in periodic table
CLO 5	Predict the acidity, basicity and reactivity of organic compounds.

	1.1 Chemical Thermodynamics (10 L)	1.1.1 Thermodynamic terms: System, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state functions and path functions, types of processes. 1.1.2 Zeroth law of thermodynamics 1.1.3 Concept of heat and work. 1.1.4 First law of thermodynamics: Internal energy (U) and enthalpy(H). Statement and mathematical relation. Sign conventions, calculations of heat (q), work (w), internal energy (U), and enthalpy (H) 1.1.5 Relation between heat capacities (Cp And Cv), Kirchoff equation. 1.1.6 Second law of thermodynamics: Heat engines, mechanical efficiency 1.1.7 Concept of entropy: Relation between enthalpy and entropy for reversible and irreversible processes, physical	15 hours

UNIT 1 Physical Chemistry		significance of entropy, entropy changes for fusion, vaporisation and transition. (Numericals expected wherever applicable)	
	1.2 Chemical Kinetics (5 L)	1.2.1 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 wherever applicable) 1.2.2 Determination of order of reaction by (a) Integration method (b) Graphical method (c) Ostwald's isolation method (d) Half time method 1.2.3 Arrhenius equation: Effect of temperature on reaction rate. Energy of activation. (Numericals expected wherever applicable)	
UNIT 2	**2.1 Atomic structure (5 L)**	2.1.1 Historical perspectives of the atomic structure: i)Rutherford's Atomic Model, ii)Bohr's theory and its limitations iii)The atomic spectrum of hydrogen atoms. Structure of hydrogen atom. iv) De Broglie's relation and Heisenberg Uncertainty Principle v) Need for a new approach to atomic structure 2.1.2 Quantum Numbers 2.1.3 Many Electron system i) Penetration and shielding ii) Effective nuclear charge iii)Aufbau principle	15 hours
	2.2 Periodic Table and periodicity (5L)	2.2.1 Long form of Periodic Table; Classification for elements as main group, transition and inner transition elements. 2.2.2 Periodicity in the following properties : Atomic and ionic size; electron gain enthalpy; ionization enthalpy,	

Inorganic Chemistry		effective nuclear charge (Slater's rule); electronegativity (Pauling, Mulliken and Alred Rochow electronegativity) (Numericals expected wherever applicable.)	
	2.3 Concept of Qualitative Analysis (5 L)	2.3.1 Types of qualitative analysis. Concept of wet and dry test in inorganic analysis. 2.3.2 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). 2.3.3 Precipitation equilibria, effect of common ions, diverse ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations) (Numericals expected wherever applicable.)	
UNIT 3 ORGANIC CHEMISTRY	**3.1Classification and Nomenclature of Organic Compounds (5L)**	3.1.1 Review of basic rules of IUPAC nomenclature. 3.1.2 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. 3.2.3 Shapes of molecules: Influence of hybridization on bond properties (as applicable to ethane, ethene, ethyne)	15 hours
	3.2 Bonding and Structure of organic compounds: (4L)	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.	
	3.3Fundamentals of organic reaction mechanism (6L)	3.3.1 Lewis structure, Formal Charge ,types of arrows, homolytic and heterolytic fission with suitable examples. Electrophiles and Nucleophiles; Nucleophilicity and basicity 3.3.2.Reactive intermediates: carbocation, carbanions and free radicals types ,structure, shape and their relative stability (primary, 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.	

SEMESTER I CHEMISTRY PRACTICALS
Course Credit :1

COURSE OBJECTIVES:

CO 1	To calibrate glassware
CO 2	To calculate the concentration of solutions
CO 3	To prepare standard solutions for volumetric analysis
CO 4	To understand kinetics of reactions practically
CO 5	To understand steps in anion detection for inorganic mixtures

COURSE LEARNING OUTCOMES : The learner will be able to

CLO 1	Calibrate glassware
CLO 2	Prepare standard solutions of exact normality
CLO 3	Perform chemical kinetics and predict order of reaction from the data

CLO 4	Carry out analysis using volumetric methods
CLO 5	Detect anions in the given inorganic mixture

1.	**Principles of Chemical Calculations:** Expressing concentration of solutions: Normality, molarity, mole fractions, % composition (weight ratio, volume ratio, weight to volume ratio), ppm. (Numericals to be solved)
2.	**Calibration of glassware:** Burette, pipettes, standard flasks.
3.	**Volumetric Analysis:** 3.1 To prepare 0.1 N succinic acid and standardize the NaOH of two different concentrations. 3.2. To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved 3.3 To standardize commercial samples of NaOH using Potassium Hydrogen Phthalate and to write material safety data of the chemicals involved.
4.	**ThermoChemistry:** To determine enthalpy of dissolution of salt (like KNO_3, $CaCl_2$)
5.	**Chemical Kinetics:**To determine the rate constant for the hydrolysis of ester using HCl as catalyst.
6.	**Semi-micro inorganic qualitative analysis of a sample containing two anions.**(From amongst): CO_3^{2-}, S^{2-} ,SO_3^{2-}, NO_3^{-1}, Cl^{-1}, Br^{-1}, I^{-1}, SO_4^{2-} [4 mixtures]
	REFERENCES: 1. Physical chemistry by McQuarrie (ISBN no.1891389505) 2. Physical Chemistry by Peter Atkins, Julio de Paula and James Keeler (ISBN; 9780198769866) 3. Concise Inorganic Chemistry by J.D.Lee(ISBN 13:978-8126575547) 4. Inorganic Chemistry by D F Shriver and Peter Atkins 5. Organic Chemistry by Graham Solomons, Craig Fryhle(ISBN;9814-12-613-6) 6. Organic Chemistry by Jonathan, Clayden,Greeves Warren (ISBN:13) oxford-198503466 7. Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013

Programme: Science Chemistry Major/Minor	**Semester – 2**

Course Title: Fundamentals of Chemistry-2		Course Code: SCHE122MJ/MN	
Number of lectures per week: **1 Theory credit is 60 minutes** **1 Practical credit is 120 minutes**		**3 Theory + 1 Practical**	
Total number of Hours in a Semester		**45 + 30**	
Credits		**4(3 theory +1 practical)**	
Evaluation System	**Summative Examination**	**2 hours**	**50 marks**
	Continuous Assessment	**--**	**50 marks**
	Practical	**–**	**50 marks**

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 understand concept of ionic equilibria, pH and buffers
CO 4	To understand the fundamental concepts of chemical bonding and reactivity
CO 5	1. To understand the stereochemistry and distinguish between the stereoisomers of the organic molecules

COURSE LEARNING OBJECTIVES: The 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	Calculate equilibrium constants and pH of aqueous solution and buffer
CLO 4	Interpret the shapes and structure of molecules on the basis of Sidwig Powell and VSEPR theories
CLO 5	Identify and differentiate between the enantiomers, diastereoisomers, stereoisomers and geometrical isomers.

	1.1 Ionic Equilibria (5L)	1.1.1 Electrolytes (Strong, moderate and weak), degree of ionization,ionization constant, factors affecting degree of ionization and ionic product of water, dissociation constants of mono-, di- and	15 hours

UNIT 1 Physical Chemistry		triprotic acid (derivation for monoprotic acid only) 1.1.2 Buffers: pH scale, types of buffers, derivation of Henderson equation for acidic and basic buffers, buffer action, buffer capacity (Numericals expected wherever applicable)	
	1.2 Gaseous State (5L)	**1.2 Gaseous State: (5 L)** 1.2.1 Ideal gas laws, kinetic theory of gases, Maxwell-Boltzmann's distribution of velocities (qualitative discussion), ideal gases versus real gases, compressibility factor, Boyle's temperature 1.2.2 Deviation from ideal gas laws, reasons for deviation from ideal gas laws, Van der Waals' equation of state 1.2.3 Joule-Thomson effect: qualitative discussion and experimentation, inversion temperature. (Numericals expected wherever applicable)	
	1.3 Chemical Equilibria (5L)	1.3.1 Reversible and irreversible reactions, law of mass action, dynamic equilibria, equilibrium constant K_c and K_p, relationship between K_c and K_p, 1.3.2 Le Chatelier's principle, factors affecting chemical equilibrium (examples and special reference to Haber's process) 1.3.3 Catalysis: Effect on chemical equilibrium, types of catalysis (homogenous and heterogenous), mechanism of catalysis (adsorption theory). (Numericals expected wherever applicable)	
	2.1: Chemical Bond and Reactivity (8 L)	2.1.1 Types of chemical bonds, comparison between ionic and covalent bonds, polarizability (Fajan's Rule), shapes of molecules, Lewis dot structure, Sidgwick, Powell Theory 2.1.2 Introduction to VBT, VSEPR theory for AB_n type molecules with and without lone pair of electrons, isoelectronic principle, applications and limitations of VSEPR theory	15 hours

UNIT 2 Inorganic Chemistry	**2.2 Comparative Chemistry of Main Group Elements: (7 L)**	2.2.1 Metallic and non-metallic nature, oxidation states, electronegativity, anomalous behaviour of second period lements, allotropy, catenation, diagonal relationship. 2.2.2 Comparative chemistry of carbides, nitrides, oxides and hydrides of group I and group II elements	
UNIT 3 ORGANIC CHEMISTRY	**3.1 Stereochemistry I (12 L)**	3.1.1 Symmetry elements, Asymmetric carbon. Classification of stereoisomers: enantiomers & diastereomers, chirality versus stereogenicity. 3.1.2 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. 3.1.3 Geometrical isomerism in alkene and cycloalkanes: cis–trans and syn-anti molecules 3.1.4 Nomenclature-relative and absolute configuration: D/L and R/S designations. with two(similar and dissimilar) chiral-centres, Diastereoisomers, meso structures, isomerism E/Z notations (as per C.I.P rules wherever applicable) 3.1.5 Conformation analysis of alkanes (ethane), relative stability with energy diagram 3.1.6 Optical activity, Specific Rotation, racemic mixture and resolution (methods of resolution not expected).	15 hours
	3.2 Introduction to aromaticity: (3 L)	3.2.1 Criteria for aromaticity (Hückel's rule), anti-aromaticity, aromatic character of arenes, cyclic carbocations /carbanions (examples using C3-C7 atoms) and heterocyclic compounds (examples with one hetero atom-O,N, S).	
	References:(Suggested Textbooks) **<u>Physical Chemistry</u>** Physical Chemistry a Molecular Approach by McQuarrie Donald A. (second edition)		

	Further Reading Physical Chemistry by Peter Atkins, Julio de Paula and James Keeler (eleventh edition) **Inorganic Chemistry** Concise Inorganic Chemistry by J.D.Lee (fifth edition) Further reading: Inorganic Chemistry by D F Shriver and Peter Atkins (fifth edition) **Organic Chemistry** Organic Chemistry by Graham Solomons, Craig Fryhle Further reading Organic Chemistry by Jonathan, Clayden,Greeves Warren Organic Chemistry Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013	

SEMESTER II CHEMISTRY PRACTICALS
Course Credit :1

COURSE OBJECTIVES:

CO 1	To understand the relevance of solubility product and common ion effect in qualitative analysis of inorganic salts
CO 2	To familiarize with concept of oxidation,reduction and redox titrations
CO 3	To introduce gravimetric methods of analysis

COURSE LEARNING OUTCOMES : Learner will be able to

CLO 1	Analyse and identify cations from a given mixture of inorganic salts using semi micro techniques
CLO 2	Analyse and quantify the given compound by redox titration and gravimetric analysis.

1.	**Semi-micro inorganic qualitative analysis of a sample containing two cations** (From amongst):Pb^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Cu^{2+}, Fe^{2+}, Ni^{2+},Zn^{2+},Mg^{2+}, Al^{3+}, K^{+},$NH4^{+}$ (Scheme of analysis to include sulphide scheme)[6 mixtures]
2.	**Concept 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. Rules for assigning oxidation number (Numericals to be solved). Balancing redox equations using the oxidation number method.
3.	**Redox Titrations** 3.1 To determine the amount of iron (II) present in a given sample by titration against a standard aqueous potassium dichromate 3.2 To calculate the concentration of KMnO4 present in a given sample by titration against oxalic acid.
4.	**Gravimetric analysis:** 4.1 To determine the percentage of sample of $BaSO_4$ containing NH_4Cl 4.2 To determine the percentage purity of ZnO containing $ZnCO_3$. 4.3 To determine the percentage of water of crystallization for hydrated crystalline salts ($CuSO_4$, $ZnSO_4$)
5.	**pH metry** 5.1 Preparation and determination of pH for a buffer. 5.2 To determine dissociation constant of weak acid (Ka) using Henderson's equation (using the method of incomplete titration pH metrically)
	Reference books ● Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009. ● Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., ● Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996

ASSESSMENT DETAILS:

I. Internal Assessment (IA): 50 marks

- 2 activities of 25 marks each
- An additional 25 mark activity will be held ONLY for those who missed any one or both of the 2 activities, due to valid reasons.

II. Semester End Examination (SEE): 50 marks

- All units of the syllabus will be covered in SEE and will be given equal weightage.
- An additional SEE will be held for those who are absent, due to valid reasons, for the main/regular SEE.

There is a single head of passing ; a student must get 40 marks out of 100 marks to clear the course but under the condition that the learner has attended IA activities and SEE. A student who fails will have to give an ATKT exam of 100 marks.

III. Practical Examination

- A 50 marks practical examination will be conducted at the end of the semester for 50 marks.
- Practical is a separate head of passing. The learner will have to get 20 out of 50 to pass the examination.

x-x-x-x-x-x-x-x-x-x

SOPHIA COLLEGE (AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science

Food Additives & Food Adulteration

(VSC 1)

Syllabus for the Academic Year 2023-2024

based on the National Education Policy 2020

DEPARTMENT OF CHEMISTRY

Programme: Science, Vocational Skill Course (VSC)		**Semester – 1**
Course Title: Food Additives & Food Adulteration		**Course Code: SVSC101**
COURSE OBJECTIVES: 1. To have knowledge and understanding about food groups, food additives and food adulterants. 2. To gain skills to test food for presence of additives and adulterants. 3. To spread awareness about consumer rights and regulations for food safety.		
COURSE OUTCOMES: The learner will be able to : 1. Identify food groups and their nutritive value. 2. Identify and perform qualitative and quantitative analysis of food for presence of additives and adulterants. 3. Apply his knowledge of food safety regulations and consumer rights in case s/he is faced with any such challenge in the future.		
Number of lectures per week: **1 Theory Lecture is 60 minutes** **1 Practical Lecture is 120 minutes**		**1 + 1**
Total number of Hours in a Semester		**15+30**
Credits		**2**
Evaluation System	**Internal Assessment 1**	**20 marks**
	Internal Assessment 2	**20 marks**
	Attendance	**10 marks**

UNIT 1 Theory	**1.1 Food groups [2L]**	Introduction to food groups - Composition and nutritive value.	15 hours
	1.2 Food Additives [4L]	1.2.1 Definition, direct and indirect additives, class of food additives 1.2.2 Role and function of food additives, interaction of food additives and effect on food characteristics 1.2.3 Coding of food additives 1.2.4 Detection of additives	
	1.3 Food Adulteration [6L]	1.3.1 Definition and types of adulteration 1.3.2 Means of adulteration, reasons for adulteration. 1.3.3 Methods of detection of adulterants in the following foods: milk,oil,sugar,spices and condiments, processed food, fruits and vegetables. (Qualitative and quantitative) 1.3.4 Difference between food additives and	

		adulterants.	
	1.4 Present law and regulations (wrt food adulteration and additives) [2L]	1.4.1 Highlights of Food safety and standards authority of India (FSSAI) 1.4.2 Role of Voluntary agencies AGMARK,I.S.I	
	1.5 Consumer Protection [1L]	Consumer's problem rights and responsibilities and Consumer Protection Act 2019	
UNIT 2 Practical	**2.1. Detection of food groups**	2.1.1 Test to identify carbohydrates :Molisch's test, Fehling's test, Benedict's test, Tollen's test and Iodine test 2.1.2 Test to identify proteins: Biuret test, Xanthoproteic test, Millions test, Ninhydrin test 2.1.3 Test to identify fats and oils: Translucent spot test, solubility test to distinguish between fats and oils, acrolein test, Hubble's test	30 hours
	2.2. Qualitative Detection of food additives	2.2.1 Detection of food additives: Aspartame(ninhydrin test),nitrite,magnesium silicate,salicylic acid,borates,saccharin(Nesselers reagent test), food colors (curcumin,caramel,annatto, chlorophyll), pyrogallate,alginate and pectin	
	2.3 Qualitative Detection of adulterants in food	2.3.1 Milk: sugar, starch, hydrogen peroxide, formalin , nitrate, benzoic and salicylic acid, borax and boric acid. Acidity test 2.3.2 Honey : Water, sugar/jaggery, glucose/high fructose corn syrup. Acidity test 2.3.3 Tea: Spent leaves, added colouring material, iron fillings 2.3.4 Coffee: Cereal/starch, scorched persimmon stones, chicory, iron fillings, colouring matter 2.3.5 Ghee/Butter: Mashed potatoes/ sweet potatoes. Acid value 2.3.6 Edible oil: Other oils in edible oil 2.3.7 Vegetables & Fruits: Malachite green on chillies or green vegetables, Rhodamine B on sweet potatoes, wax polish on apples 2.3.8 Cereals : Rhodamine B in ragi, turmeric in sella rice, bran in wheat flour. 2.3.9 Spices and condiments: saw dust in spices, lead chromate in turmeric, papaya seeds in pepper, grass	

		seeds in cummin, artificial colour in chili powder/saffron	
	2.4 Quantitative determination	2.4.1 Benzoic acid in carbonated beverages 2.4.2 Acetic acid in synthetic vinegar 2.4.3 Boric acid in milk	
	2.5 Project work	2.5.2 Each student will select five packaged food items and identify the additives present in it and their type 2.5.2 Students will undertake a case study on impact of adulteration on public health or a food additive that caused health issues (preferably in the last 15 years)	
	REFERENCES: 1. A first course in food analysis- A.Y.Sathe, New Age International Ltd,1999 2. Food safety, case studies- R V Bhat, NIN,1992 3. https://www.fssai.gov.in 4. https://indianlegalsolution.com/law on food adulteration 5. https://vikaspedia.in		

x-x-x-x-x-x-x-x

SOPHIA COLLEGE

ऊर्ध्वं मूलः

AUTONOMOUS

SOPHIA COLLEGE (AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science

Introduction to Cosmeticology

(VSC 2)

Syllabus for the Academic Year 2023-2024

based on the National Education Policy 2020

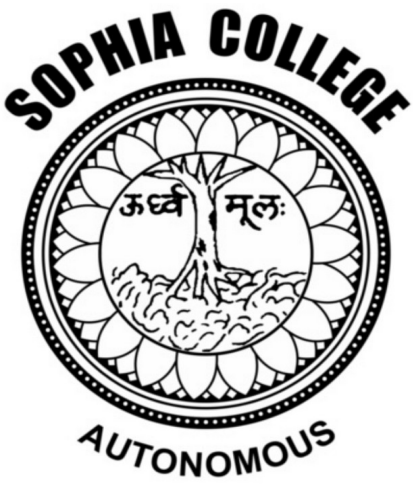
DEPARTMENT OF CHEMISTRY

Programme: Science, Vocational Skill course (VSC)		**Semester – 1**
Course Title: Introduction to Cosmeticology		**Course Code: SVSC102**
COURSE OBJECTIVES: 1. To learn the basics of cosmetics 2. To gain knowledge on basic principles of cosmetic chemistry, composition, formulation and function of various cosmetic components. 3. To learn how to prepare various formulations and their qualitative analysis		
COURSE OUTCOMES: The learner will be able to : 1. Identify and classify cosmetic products 2. Predict the components of the product and their function 3. Prepare various cosmetic formulations 4. Carry out qualitative analysis of cosmetic products		
Number of lectures per week: **1 Theory Lecture is 60 minutes** **1 Practical Lecture is 120 minutes**		**1 + 1**
Total number of Hours in a Semester		**15+30**
Credits		**2**
Evaluation System	**Internal Assessment 1**	**20 marks**
	Internal Assessment 2	**20 marks**
	Attendance	**10 marks**

UNIT 1 Theory	**1.1 Basics of cosmetics**	Definition of cosmetics, historical background, classification, functions and properties.	2L
	1.2 Skin Products	Structure of skin, composition and functions of face powders, talcum powders, compact powders: Face cream, cold cream,sunscreen	5L
	1.3 Hair Products	Structure of hair, hair dyes and its types: temporary, semi-permanent and permanent, hair sprays and shampoo	3L
	1.4 Coloured products:	Structure of nail, nail polish, nail polish remover and lipsticks	2L
	1.5 **Hygiene Products**	Antiperspirants and deodorants, toothpaste, tooth powders and mouthwash	3L
UNIT 2 Practical	**2.1. Preparation Preparation of cosmetic formulation**	2.1.1 Preparation of talcum powder 2.1.2 Preparation of toothpaste/tooth powder 2.1.3. Preparation of nail polish/ nail polish remover 2.1.4. Preparation of hair colour/ shampoo 2.1.5.Preparation of Lip Balm /lipsticks 2.1.6. Preparation of Hand Wash/sanitizer.	

	2.2 Qualitative Analysis of cosmetic products	2.2.1. Estimation of Mg in talcum powder 2.2.2. Estimation of acetone in nail polish remover (demonstration) 2.2.3. Estimation of Zn in deodorants complexometrically	30 hours
	2.3. Assay of products	**Assay of shampoo/body wash**	
	REFERENCES: **<u>Unit 1</u>** 1. Cosmetic Formulation: Principles and Practice - Heather A.E. Benson, Michael S. Roberts, Vania Rodrigues Leite-Silva, Kenneth Walters 2. Perfumes, Cosmetics and soaps, ninth edition, – W. A. Poucher. 3. Naturals and Cosmetics – by Dr. Satish Sakharwade 4. Manufacture of Perfumes, Cosmetics & Detergents – Giriraj Prasad 5. Cosmetics: Science & Technology – Sagarin. **<u>Unit 2</u>** 1. Vogel's textbook of Qualitative Chemical Analysis (Longman ELBS Edition) 2. Vogel's textbook of Quantitative Analysis (Longman ELBS Edition) 3. Practical Organic Chemistry by A.I. Vogel 4. Practical Organic Chemistry by O.P. Agrawal. 5. Practical Organic Chemistry by F. G. Mann & B. C. Sounders 6. Comprehensive Practical Organic Chemistry Qualitative Analysis by V. K. Ahluwalia 7. Cosmetics-Formulation, manufacture and Quality Control by P.P Sharma Vandana Publications Pvt. Ltd		

x-x-x-x-x-x-x-x



SOPHIA COLLEGE (AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science

Minerals and Metals in Ancient India

(IKS 105)

Syllabus for the Academic Year 2023-2024

based on the National Education Policy 2020

DEPARTMENT OF CHEMISTRY

Programme: Science, Indian Knowledge System (IKS)		**Semester – 1**
Course Title: Minerals and Metals in Ancient India		**Course Code: IKS105**
COURSE OBJECTIVES: 1. To have knowledge and understanding about the minerals and metals that were used in Ancient India. 2. To learn about the richness of ancient Indian metallurgy. 3. To understand how the use of metals and minerals evolved in Pre-Harappan and Harappan era.		
COURSE LEARNING OUTCOMES: The learner will be able to : 1. Appreciate and discuss the evolution of the use of metals in ancient India. 2. Acquire knowledge of how metals and minerals played an important role in evolution. 3. Apply the acquired knowledge in understanding archeological discoveries, ancient art and cultures.		
Number of lectures per week: 2 Theory Lectures (60 mins each)		**2**
Total number of Hours in a Semester		**15+15**
Credits		**2**
Evaluation System	**Internal Assessment 1**	**20 marks**
	Internal Assessment 2	**20 marks**
	Attendance	**10 marks**

UNIT 1	**1.1 Minerals and Metals in the Rigveda**	1.1.1 Transition from Neolithic to Chalcolithic age 1.1.2 Fire in Metallurgy 1.1.3 The meaning of Ayas 1.1.4 Some metallic objects 1.1.5 Ornaments and gems	7 hours
	1.2 Minerals and metals in the vedic literature	1.2.1 Minerals and metals 1.2.2 Different kinds of ayas 1.2.3 Use of Tin	7 hours

		1.2.4 Use of Lead 1.2.5 Ornamental and Barter metals 1.2.6 Iron implements 1.2.7 Potteries and other inorganic materials 1.2.8 Mani in vedic literature	
UNIT 2	**2.1 Pre-Harappan Era**	2.1.1 Introduction 2.1.2 Mehargarh, Mundigak 2.1.3 Other pre-harappan site of west of Indus 2.1.4 Nuclear zones east of indus 2.1.5 Pre-harappan culture in Rajasthan 2.1.6 Ganeshwar-Jodhpura culture 2.1.7 Sothi culture on the sarasvati valley	11 hours
	2.2 Project work	2.2.1 Review on Documentaries 2.2.2 Report on visit to museums (Physical/virtual)	5 hours
	Reference: 1. Minerals and metals of Ancient India - Arun Kumar Biswas, DK Print world Ltd, 1st edition 2. http://eprints.nias.res.in/374/1/B8-2013%20Minerals%20and%20Metals%20Heritage%20of%20India.pdf 3. https://www.tf.uni-kiel.de/matwis/amat/def_en/articles/metallurg_heritage_india/metallurgical_heritage_india.html#:~:text=The%20commonly%20used%20metals%20in,achievements%20of%20ancient%20Indian%20metallurgists. 4. https://eprints.nmlindia.org/5802/1/1-24.PDF 5. https://vedicheritage.gov.in/vedic-heritage-in-present-context/metallurgy/	

SOPHIA COLLEGE (AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science

Journey of Metals: Ores to alloys

(SEC 1)

Syllabus for the Academic Year 2023-2024

based on the National Education Policy 2020

DEPARTMENT OF CHEMISTRY

Programme: Science, Skill Enhancement course (SEC 1)		**Semester – 2**
Course Title: Journey of Metals: Ores to alloys		**Course Code:**
COURSE OBJECTIVES: 1. To have knowledge and understanding about ores and alloys 2. To gain skills to test ores and alloys for their metal content		
COURSE LEARNING OUTCOMES: The learner will be able to : 1. Identify composition of ores and alloys 2. Identify and perform quantitative determination of metallic composition of ores and alloys		
Number of lectures per week: **1 Theory Lecture is 60 minutes** **1 Practical Lecture is 120 minutes**		**1 + 1**
Total number of Hours in a Semester		**15+30**
Credits		**2**
Evaluation System	**Continuous Assessment 1 Theory**	**20 marks**
	Continuous Assessment 2 Practical	**20 marks**
	Attendance	**10 marks**

UNIT 1 Theory	**1.1 Introduction to ores [1L]**	Basic terminology in metallurgy: minerals, ores, gangue, flux, slag Occurrence of ore and types of ore	15 hours
	1.2 Extractive techniques [2L]	Hydraulic washing, leaching, froth floatation, magnetic separation	
	1.3 Metallurgical process [2L]	Pyrometallurgy, hydrometallurgy, electrometallurgy	
	1.4 Extraction of metals from their ores [4L]	a) Iron from hematite b) Aluminum from bauxite c) Nickel from oxide ores d) Copper from copper pyrites	
	1.5 Introduction to alloys [1L]	Alloying of metals, types of alloys, purpose of alloying and their importance	
	1.6 Chemical composition , methods of estimation and application of	a) Alloys of iron: steel, stainless steel b) Alloys of copper: Brass, bronze, german silver, gun metal c) Alloys of aluminum: Duralumin, Magnalium	

	alloys [5L]	d) Alloys of nickel: Inconel, Monel metal, nichrome, haste alloy	
UNIT 2 Practical	**Opening of ores and their analysis**	a)Analysis of hematite b)Analysis of limestone	30 hours
	Opening of alloys and their estimation	a) Magnalium (magnesium by complexometry) b) Monel metal (nickel by complexometry) c) Brass (zinc by potassium ferrocyanide titration)	
	Estimation of the metal from synthetic samples of alloys	a) Iron in steel by redox titration. b) Copper in bronze by iodometry (drop method) c) Aluminium in Duralumin by complexometry (back titration method) d) Estimation of nickel in nichrome by complexometry	
	REFERENCES: **THEORY** 1. Chemical analysis of metals ; Sampling and analysis of metal bearing ores: American Society for Testing and Materials 1980 - Technology & Engineering 2. Manual of Procedures for Chemical and Instrumental Analysis of Ores, Minerals, and Ore Dressing Products. Government of India Ministry of Steel & Mines, Indian Bureau of Mines, 1979. 3. Alloying: understanding the basics, edited by Joseph R. Davis, ASM International (2001). 4. Zone refining and allied techniques, Norman L. Parr, G. Newnes Technology & Engineering (1960) **PRACTICALS** 1. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1stEdition., 2010., U.N. Dhur & Sons Pvt Ltd 2. The Synthesis and Characterization of Inorganic Compounds by William L. Jolly 3. Inorganic Chemistry Practical Under UGC Syllabus for M.Sc. in all India Universities By:Dr Deepak Pant		

SOPHIA COLLEGE (AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science

Chemistry of the universal solvent: Water

(SEC 2)

Syllabus for the Academic Year 2023-2024

based on the National Education Policy 2020

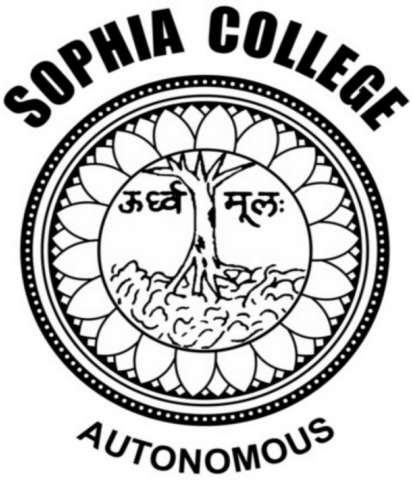
DEPARTMENT OF CHEMISTRY

Programme: Science, Skill Enhancement course (SEC)		**Semester – 2**
Course Title: Chemistry of the universal solvent: Water		**Course Code:**
COURSE OBJECTIVES: 1. To gain knowledge of the general properties of water and quality parameters. 2. Understand the chemistry of the various parameters of water. 3. Learn about water resources, pollution and its causes and control. 4. To be able to analyze water samples.		
COURSE OUTCOMES: The learner will be able to : 1. Explain the various properties of water. 2. Apply their knowledge towards preventive and remedial measures. 3. Design models for water conservation. 4. Carry out quantitative analysis of water samples.		
Number of lectures per week: **1 Theory Lecture is 60 minutes** **1 Practical Lecture is 120 minutes**		**1 + 1**
Total number of Hours in a Semester		**15+30**
Credits		**2**
Evaluation System	**Continuous Assessment 1 Theory**	**20 marks**
	Continuous Assessment 2 Practical	**20 marks**
	Attendance	**10 marks**

UNIT 1 Theory	**1.1 Origin of the universal solvent [1L]**	Sources of water, water cycle	15 hours

	1.2 Chemical and physical properties [3L]	Structure, density, anomalous behaviour of water, conductivity, surface tension, dipole moment, specific heat capacity, capillary action, solvation and auto-ionization. Heavy water, supercritical water.	
	1.3 Standards and Important Parameters for Measuring the quality of water [6L]	Standard for Industrial and potable water. pH, acidity, alkalinity, salinity, total hardness, dissolved oxygen, chemical oxygen demand, biochemical oxygen demand, total solids, total suspended solids, total dissolved solids. (numericals to be included wherever applicable)	
	1.4 water pollution prevention and control [3L]	Water pollution, classification of pollutants, prevention and control.	
	1.5 Water Conservation, through law, methods of conservation [2L]	The Water Act Rain water harvesting, watershed management.	
UNIT 2 Practical	1. To determine the acidity of the given water sample. 2. To determine the alkalinity of the given water sample 3. To determine the total hardness of water. 4. To determine the dissolved oxygen in the given water sample. (demonstration) 5. To determine the chemical oxygen demand of the given water sample. 6. To determine the physical parameters of water samples from different sources. 7. To determine the total solids, total dissolved solids, total suspended solids in the given water sample. 8. To determine the salinity of the water sample. (demonstration) 9. Determination of sulphate. (by Benzidine method)		30 hours
	REFERENCES: **<u>THEORY</u>** 1. Chemistry the molecular nature of matter and change, Martin S. Silberberg, 4th Edition, McGraw Hill International edition 2006		

	2. Environmental chemistry, H Kaur, 7th Addition Pragati Prakashan 3. Textbook of Environmental Chemistry, Balram Pani, I.K International Publishing House Pvt Ltd 4. Environmental Chemistry A.K De, 5th Edition New Age International (P) Ltd **PRACTICALS** 1. Applied Chemistry Theory and Practice O.P Vermani, A.K Narula, 2ndEdition., New Age International (P) Ltd 2. Vogel's textbook of Quantitative Analysis (Longman ELBS Edition)	



SOPHIA COLLEGE (AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science

Serendipity: Discoveries triggered by chance

(OE 206)

Syllabus for the Academic Year 2023-2024

based on the National Education Policy 2020

DEPARTMENT OF CHEMISTRY

Programme: Science, Open Elective (OE)		**Semester – 2**
Course Title: Serendipity: Accidental discoveries by chance		**Course Code: OE206**
COURSE OBJECTIVES: 1. To learn about the amazing discoveries that were made accidentally. 2. To study the current status of those accidental discoveries in the current time.		
COURSE LEARNING OUTCOMES: The learner will be able to : 1. Paraphrase the important discoveries that changed the world. 2. Evaluate what is the importance of the studied discoveries in the present times.		
Number of lectures per week: **2 Theory Lecture is 60 mins**		**2**
Total number of Hours in a Semester		**30**
Credits		**2**
Evaluation System	**Continuous Assessment 1**	**20 marks**
	Continuous Assessment 2	**20 marks**
	Attendance	**10 marks**

UNIT 1	**1.1 Discoveries in medicine**	• Quinine • Smallpox vaccine • X-rays, radioactivity, pacemaker • Allergy • Antibiotic, Insulin, Penicillin • Pap smear • Porphyrin • Lithium injections (psychiatric disorders) • Anaesthesia • Warfarin, Thalidomide, nitrogen mustard	15 hours
	1.2 Discoveries in food	• Chocolate chip cookies, Corn flakes, potato chips, Cheese puffs • Worcestershire Sauce • Tofu • Ice-cream cones, popsicles	

		• Pasteurization • Artificial Sweetener • Coca cola,Champagne, Brandy, Beer • Tea bags	
UNIT 2	**2.1 Discoveries in Cosmetics/chemicals**	• Vaselin (petroleum jelly) • Botox, psoriasis therapy • Hair disorders, Permanent hair removal • Nano silk - skin treatment • Titanium dental implants • Aesthetic Dermatology • Dynamite, matches, gun powder, gun cotton • drycleaning, mauveine	15 hours
	2.2 Discoveries in Polymers	• Teflon • Superglue, sticky notes, silly putty, play dough • Safety glasses • Plastic, Cling wrap, bubble wrap • Vulcanized rubber, scotchgard • Polymerase chain reaction (PCR) • Smart dust • Velcro • 3D bioprinting	
	REFERENCES: • https://www.vedantu.com/blog/medical-inventions-that-changed-the-world • https://hms.harvard.edu/about-hms/history-hms/timeline-discovery • https://www.mentalfloss.com/article/646971/inventions-that-changed-food-history • https://www.pharmacytimes.com/view/5-surprising-stories-of-accidental-drug-discoveries • https://www.museumofplay.org/toys/silly-putty/ • https://www.usf.edu/research-innovation/rf/usf-connect/documents/corridor/corridor_stemgenesisfeature_2016.pdf • https://www.lexology.com/library/detail.aspx?g=c2ca3b70-b545-4121-aa95-923de6068fc0 • https://www.britishscienceweek.org/app/		

	uploads/2015/10/NSEW-Accidental-Discoveries-Primary-PackFULLOPT.pdf • https://www.sciencedaily.com/news/health_medicine/cosmetics/#page=2 • https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4372903/ • https://www.pbs.org/wgbh/nova/article/accidental-discoveries/ • https://www.cbsnews.com/news/botox-a-story-with-a-few-wrinkles/ • https://www.earth.com/news/cure-balding-gray-hair/ • https://www.readersdigest.ca/health/beauty/birth-botox/ • https://news.cuanschutz.edu/department-of-surgery/new-cosmetic-cream-created-at-cu-leaves-skin-silky-smooth • https://www.linkedin.com/pulse/accidental-inventions-pacemaker-r-k-dewan-co • https://radiantdentistry.com/blog/the-accidental-discovery-of-titanium-dental-implants • https://www.goethe.de/prj/mis/en/mit/21902211.html • https://www.goethe.de/prj/mis/en/mit/tte.html • https://247wallst.com/special-report/2022/07/19/accidental-discoveries-that-changed-the-world/ • https://www.aps.org/publications/apsnews/200111/history.cfm • https://www.thehindu.com/children/Gunning-for-guncotton/article16763412.ece •	

ASSESSMENT PATTERN

DISCIPLINE SPECIFIC COURSE (DSC)

I.CONTINUOUS ASSESSMENT CA: 50 MARKS
1-Activity 25 Marks
1-Test 25 Marks

II. SUMMATIVE ASSESSMENT (SA): 50 MARKS (SUBJECTIVE)
All units of the syllabus will be covered in SEE and will be given equal weightage.
Q.1. Unit 1 : Attempt any three of the following. (3 out of 6) [15marks]
Q.2. Unit 2 : Attempt any three of the following. (3 out of 6) [15marks]
Q.3. Unit 3 : Attempt any three of the following. (3 out of 6) [15marks]
Q.4. Unit 4 : Attempt any one of the following. (1 out of 2) [5 marks]

CA, and SA are a single head of passing. The learner will have to get 40 out of 100 to pass the examination.

IV. PRACTICAL EXAMINATION
A 50 marks practical examination will be conducted at the end of the semester for 50 marks.
Practical 40M
Journal 5M
Viva-voce 5M
Total 50M

III.CONTINUOUS ASSESSMENT(For VSC,SEC)
Assignment of 20M

Practical examination 20M
Attendance 10M

CONTINUOUS ASSESSMENT (for OE, IKS)
Assignment of 40M
Attendance 10M