

AC/I/(23-24).3.RUS5

S. P. Mandali's
Ramnarain Ruia Autonomous College
(Affiliated to University of Mumbai)



Syllabus for
Program: F.Y.B.Sc.

Program Code: (RUSCHE)

(As per the guidelines of National Education Policy 2020-
Academic year 2023-24)

(Choice based Credit System)



PROGRAM OUTCOMES

S. P. Mandali's Ramnarain Ruia Autonomous College has adopted the Outcome Based Education model to make its science graduates globally competent and capable of advancing in their careers. The Bachelors Program in Science also encourages students to reflect on the broader purpose of their education.

PO	Description
A student completing Bachelor's Degree in Science program will be able to:	
PO 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
PO 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.
PO 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
PO 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
PO 5	Take complex challenges, work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
PO 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
PO 7	Follow ethical practices at work place and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
PO 8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner.



PROGRAM SPECIFIC OUTCOMES

PSO	Description
A student completing Bachelor's Degree in Science program in the subject of Chemistry will be able to:	
PSO 1	Acquire the fundamental knowledge of the main branches of chemistry viz. Physical, Inorganic, Organic and Analytical.
PSO 2	Identify and separate components of organic or inorganic origin and will also be able to analyse them by making use of the modern instrumental methods learned.
PSO 3	Communicate the results of the scientific work in oral as well as written format to both the scientists and the public at large.
PSO 4	Establish themselves as effective professionals and function as a member of an interdisciplinary problem solving team by demonstrating the critical thinking, problem solving & analytical reasoning skills while developing solutions or strategies for solving the real problems through the use of the chemistry knowledge gain during the course.
PSO 5	Appreciate the central role of chemistry in our society and use this as a basis for ethical behaviour in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in terms of energy, health and medicine.
PSO 6	Develop skills that will prepare them not only for immediate employment but also for life-long learning in advanced areas of Chemistry and related fields.



CREDIT STRUCTURE BSc

Semester	Subject 1		Subject 2	GE/ OE course (Across disciplines)	Vocational and Skill Enhancement Course (VSC) & SEC	Ability Enhancement Course/ VEC/IKS	OJT/FP/CEPC, RP	Total Credits
	DSC	DSE						
1	4		4	4 (2*2)	VSC-2 + SEC -2	AEC- 2 (CSK) + VEC- 2 (Env Sc.) + IKS-2		22
2	4		4	4 (2*2)	VSC-2 + SEC-2	AEC-2 (CSK)+ VEC-2 (Understanding India)	CC-2	22
Total	8		8	8	8	10	2	44
Exit option: award of UG certificate in Major with 44 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor								
3	Major 8		Minor 4	2	VSC-2	AEC-2 MIL	FP -2, CC-2	22
4	Major 8		Minor 4	2	SEC-2	AEC-2 MIL	CEP-2, CC-2	22
Total	16		8	4	4	4	8	44
Exit option: award of UG Diploma in Major with 88 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor								
5	DSC 12	DSE 4	Minor 2		VSC-2		CEP/FP-2	22
6	DSC 12	DSE 4	Minor 2				OJT-4	22



Total	24	8	4		2		6	44
	Exit option: award of UG Degree in Major with 132 credits or Continue with Major for Honours/ Research							

Course Code:

Course Title:

Type of Course: Discipline Specific Core Course

Academic year 2023-24

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	A student completing this course will be able to:
CO 2	



FYBSc Syllabus 2023-24 (As per NEP)

PROGRAM OUTLINE 2023-24

Semester	Course Code	Course Title / Unit Title		Credits
I	RUSCHE.O101	Chemistry - I		3
		Unit-I	Chemical Kinetics	
		Unit-II	Periodicity of Properties Chemical Bond and Reactivity	
		Unit-III	Fundamentals of Organic Chemistry	
		Practical		1
II	RUSCHE. E111	Chemistry - I		3
		Unit-I	Chemical Thermodynamics	
		Unit-II	Oxidation Reduction Chemistry Acid-Base Theories	
		Unit-III	Stereochemistry	
		Practical		1



Unit	Content	No of Lectures
I	<p>Chemical Kinetics</p> <p>1.1.1 Rate of a reaction, rate constant and measurement of reaction rates.</p> <p>1.1.2 Order and molecularity of reaction.</p> <p>1.1.3 Integrated rate equation for zero, first and second order reactions (with equal and unequal initial concentration of the reactants).</p> <p>1.1.4 Kinetic characteristics of zero, first and second order reactions. 1.1.5 Numerical problems based on zero, first and second order reactions, Applications of kinetic study</p> <p>1.1.6 Methods for the determination of the order of a reaction.</p>	15
II	<p>2.1 Periodic Table and Periodicity of Properties.</p> <p>2.1.1 Long form of the Periodic Table; Classification of elements as main group, transition, and inner transition elements;</p> <p>2.1.2 Periodicity in the following properties: Atomic and ionic size; electron gain enthalpy; ionization enthalpy, effective nuclear charge ; Electronegativity</p> <p>2.2 Chemical Bond and Reactivity</p> <p>2.2.1 Types of chemical bonds; comparison between ionic and covalent bonds; polarizability and its effect on a bond, (Fajan's Rules).</p> <p>2.2.2 Shapes of simple molecules: Lewis dot structures; Sidgwick-Powell theory; Basic VSEPR Theory for AB_n type of molecules (neutral or charged species), with and without lone pair of electrons.</p> <p>2.2.3 Isoelectronic species; applications and limitations of VSEPR Theory.</p>	15



<p>III</p>	<p>Fundamentals of Organic Chemistry</p> <p>3.1 Nomenclature of Organic Compounds:</p> <p>3.1.1 IUPAC nomenclature of mono functional aliphatic compounds.</p> <p>3.1.2 IUPAC nomenclature of bi-functional aliphatic compounds and their cyclic analogues.</p> <p>3.2 Basic concepts involved in organic reaction mechanism</p> <p>3.2.1 Electronic Effects: Inductive, electromeric, resonance effects, hyperconjugation.</p> <p>3.2.2 Carbocations, Carbanions and Free radicals:</p> <p>Homolytic and heterolytic fission, examples of the same.</p> <p>3.2.3 Formation of carbocations, carbanions and free radicals. (primary, secondary, tertiary, allyl, benzyl), their relative stability.</p> <p>3.2.4 Organic acids and bases; their relative strengths.</p>	<p>15</p>
<p>Practical</p>	<ol style="list-style-type: none"> 1. To determine the individual strength of Sodium Carbonate and Sodium Bicarbonate in a mixture of the two using two indicators. 2. To determine the acid neutralising capacity of commercially available samples of antacid. 3. Purification of a given organic compounds by recrystallisation (Three compounds) 4. To determine the rate constant of the acid catalyzed hydrolysis of methyl acetate. 	
	<p>References:</p> <ol style="list-style-type: none"> 1. Ball D.W., Physical Chemistry, Thomson Press, India (2007). 2. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004). 3. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013). 4. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press(2014). 5. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd., New Delhi (2004). 6. Levine I.N., Physical Chemistry, 6th Ed., Tata Mc Graw Hill 	



	<p>(2010).</p> <p>7. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).</p> <p>8. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.</p> <p>9. 2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970</p>	
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SEMESTER II

Unit	Content	No of Lectures
I	Chemical Thermodynamics 1.1 Fundamental concepts in Thermodynamics: The macroscopic variables basic definitions needed to describe thermodynamic systems, equations of state and the ideal gas law. 1.2 First Law of Thermodynamics : Work, heat, and internal energy, Operational definitions, the molecular interpretation of heat, work and internal energy, the formulation of the First Law, state functions, and path functions 1.3 Work: The general expression for work, Expansion against constant pressure, Reversible expansion, Comparing Work for Reversible and Irreversible Processes 1.4 Heat transactions: Heat capacity, the definition of enthalpy, Enthalpy change and heat transfer, the variation of enthalpy with temperature. Heat capacity at constant pressure and volume, the relation between heat capacities.	15



<p>II</p>	<p>2.1 Oxidation Reduction Chemistry</p> <p>2.1.1 Oxidation state, oxidation number, oxidation- reduction in terms of oxidation number</p> <p>2.1.2 Balancing redox equations by i) oxidation number method and ii) ion- electron method.</p> <p>2.1.3 Calculation of equivalent weight on the basis of chemical nature.</p> <p>2.2 Acid-Base Theories</p> <p>2.2.1 Arrhenius; Lowry-Bronsted concept ; Classification of solvents, auto dissociation of amphiprotic solvents, Lewis concept ; Usanovich concept</p> <p>2.2.2 Hard and Soft Acids and Bases-HSAB (with respect to occurrence and feasibility of chemical reaction)</p>	<p>15</p>
<p>III</p>	<p>Stereochemistry</p> <p>3.1.1 Optical Isomerism: optical activity, specific rotation, chirality, enantiomers, molecules with two similar and dissimilar chiral-centres, distereoisomers, mesostructures, racemic mixture.</p> <p>3.1.2 Flying-wedge, Fischer, Newman and Sawhorse projection formulae (erythro, threo isomers) and their interconversion.</p> <p>3.1.3 Relative and absolute configuration: D/L and R/S designations.</p> <p>3.1.4 Geometrical isomerism in alkenes and cycloalkanes: cis–trans isomerism and E/Z notations with C.I.P rules.</p>	<p>15</p>



	3.1.5 Conformational analysis of alkanes (ethane, propane and n-butane) and their relative stability on the basis of energy diagrams.	
Practical	<ol style="list-style-type: none"> 1. Standardization of Sodium thiosulphate solution. 2. Determination of the strength of supplied Iodine solution. 3. Acetylation of primary amine 4. Bromination of aniline. 5. To study thermodynamic parameters of simple chemical reactions. 6. To determine the value of ideal gas constant R in different units by eudiometer method. 	
	<p>References:</p> <ol style="list-style-type: none"> 1. Ball D.W., Physical Chemistry, Thomson Press, India (2007). 2. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004). 3. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013). 4. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press(2014). 5. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000). 6. Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India)Pvt Ltd. (Pearson Education).2012 7. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd.(Pearson Education). 8. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry ofNatural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education). 9. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley:London, 1994. 10. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International,2005. 	



MODALITY OF ASSESSMENT

Sr. No.	Number of Credits	Total Marks	Internal Assessment (Marks)	Internal Assessment (Pattern)	Semester End Examination(Marks)	Semester End Examination(Pattern)	Duration of Semester End Exam
1	3	75	30	a)1 Class Test of 20 Marks b)1 Assignment of 10 Marks	45	Three Questions of 15 Marks each	1 Hr 30 Mins