



**SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)**

Affiliated to the University of Mumbai

Programme: Science

**T.Y.B.Sc. CHEMISTRY (Minor)**

**Syllabus for the Academic Year 2025-2026 based on  
the National Education Policy 2020**



**SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)**  
**DEPARTMENT OF CHEMISTRY**

**COURSE DETAILS FOR MINOR:**

	<b>SEMESTER 5</b>		<b>SEMESTER 6</b>
<b>TITLE</b>	General Chemistry - III		General Chemistry - IV
<b>TYPE OF COURSE - DSC</b>	Minor		Minor
<b>CREDITS</b>	2		2



## SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

### **Preamble:**

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



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## PROGRAMME OBJECTIVES

<b>PO 1</b>	The students are expected to understand the basic concepts in chemistry and be aware of the recent development in the subject area.
<b>PO 2</b>	To inculcate critical thinking and scientific attitude in the students.
<b>PO 3</b>	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 OUTCOMES

<b>PSO 1</b>	<b>Core competency:</b> The chemistry graduates are expected to gain theoretical and practical knowledge of the basic concepts in chemistry.
<b>PSO 2</b>	<b>Skill development:</b> They would acquire necessary skills and training to pursue higher studies in the field of chemistry and to be an entrepreneur.
<b>PSO 3</b>	<b>Responsible citizens:</b> The students will get trained to adopt and practice sustainable techniques for their personal growth and to address societal and environmental problems



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<b>Programme: Sciences CHEMISTRY MINOR</b>		<b>Semester – 5</b>	
<b>Course Title: General Chemistry-III</b>		<b>Course Code: SCHE355MN</b>	
<p><b><u>COURSE OBJECTIVES:</u></b></p> <p>1. To explain the basic principles of electrochemistry and apply electrochemistry in real-world contexts like corrosion.</p> <p>2. To introduce the fundamental concepts of coordination chemistry, including ligands, coordination number, and complex formation.</p>			
<p><b><u>COURSE OUTCOMES:</u></b> The learner will be able to :</p> <p>1. interpret electrochemical data and propose electrochemical solutions for corrosion protection &amp; VBT for coordination compounds.</p> <p>2. define and classify coordination compounds, ligands, and coordination numbers using IUPAC nomenclature, apply VBT to predict geometry &amp; magnetic properties</p>			
<b>Theory Lectures per week (1 Lecture is 60 minutes)</b>		<b>1</b>	
<b>Total number of Hours in a Semester</b>		<b>15</b>	
<b>Credits</b>		<b>1</b>	
<b>Evaluation System</b>	<b>Summative Assessment</b>	<b>1 Hour</b>	<b>25 marks</b>
	<b>Continuous Assessment</b>	<b>--</b>	<b>-</b>



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<b>UNIT 1</b> (1 Credit)	<b>1.1</b>	<b>Electrochemistry – II</b> 1.1.1 Conductivity, Equivalent and Molar Conductivity (Numericals expected) and their variation with dilution of weak and strong electrolytes, Debye-Huckel Onsager Equation (no derivation) and its verification. 1.1.2 Kohlrausch Law of Independent Migration of ions and its application: Determination of Ionization constant of a weak electrolyte, Solubility of a sparingly soluble salt and ionic product of water (Numericals expected) 1.1.3 Transference Number and Its Experimental Determination using Moving Boundary Method (Numericals expected) 1.1.4 Corrosion: Introduction, types of corrosion, 1.1.5 Electrochemical theory of corrosion (no derivation). Importance of protection of metals from corrosion, methods of protection viz. coating, electroplating, cathodic protection, anodizing, sacrificial coating	<b>15 Hours</b>
	<b>1.2</b>	<b>Co-ordination Chemistry</b> 1.2.1 Introduction: Basic terms, types of ligands, nomenclature of co-ordination compounds, isomerism and its types 1.2.2 Werner's theory of coordination, effective atomic number rule, sixteen and eighteen electron rule 1.2.3 Shapes of d-orbitals and its orientation 1.2.4 Nature of the Metal-Ligand Bond: Valence Bond Theory: hybridisation - $sp^3$ , $dsp^2$ , $sp^3d^2$ , $d^2sp^3$ (Inner and outer orbital complexes of Mn(II), Fe(II), Fe(III), Co(II), Co(III), Ni(II), Cu(II), Zn(II) with ligands like aqua, ammonia, cyanide and halides) 1.2.5 Limitations of V.B.T with respect to co-ordination compounds. 1.2.6 Uses of coordination compounds: medicinal, biological, industrial and as laboratory reagents	



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<b>PRACTICAL</b>  <b>General Chemistry-III</b>	<b>SEMESTER 5</b>  <b>Course Code: SCHE355MNP</b>
<b><u>COURSE OBJECTIVES:</u></b>	
<ol style="list-style-type: none"> <li>1. To construct an electrochemical cell and use potentiometry for analysis of electrochemical parameters.</li> <li>2. To prepare inorganic complex and estimation of metal ions by complexometric titrations</li> </ol>	
<b><u>COURSE OUTCOMES:</u></b> The learner will be able to	
<ol style="list-style-type: none"> <li>1. construct electrochemical cells and use knowledge of potentiometry for different estimations</li> <li>2. prepare inorganic complexes and analysis of metal ions by complexometry</li> </ol>	

<b>Lectures per week (1 Lecture is 120 minutes)</b>	<b>1</b>		
<b>Total number of Hours in a Semester</b>	<b>30</b>		
<b>Credits</b>	<b>1</b>		
<b>Evaluation System</b>	<b>Summative Assessment</b>	<b>3 Hours</b>	<b>25marks</b>
	<b>Continuous Assessment</b>	--	

	<ol style="list-style-type: none"> <li>1. To determine the solubility product and solubility of AgCl potentiometrically using a chemical cell.</li> <li>2. To determine the solubility product and solubility of AgCl potentiometrically using a concentration cell</li> <li>3. To determine the activity coefficient of Ag ions using a concentration cell without transference</li> <li>4. To titrate a mixture of weak acid and strong acid against a strong base and to determine the amount of each acid in the mixture conductometrically.</li> <li>5. Preparation of tris(ethylenediamine) nickel(II) thiosulphate complex.</li> <li>6. Determination of nickel by complexometrically in tris(ethylenediamine)nickel(II)thiosulphate.</li> <li>7. Preparation of tetra amine copper complex.</li> <li>8. Estimation of copper by complexometrically in tetra amine copper complex</li> </ol>	60 hours
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## SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

### **ASSESSMENT DETAILS:**

1. Continuous assessment (CA): Any one activity / assignment of 25 marks One Test 25 marks
2. Summative assessment (SA): Theory exam of 50 marks – Two hour duration
3. Summative assessment (SA: Practical exam of 50 marks – Three hours duration

### **REFERENCES:**

#### **SCHE355MN General Chemistry -III THEORY**

1. Physical Chemistry, Ira Levine, 5th Edition, 2002 Tata McGraw Hill Publishing Co. Ltd.
2. Physical Chemistry, P.C. Rakshit, 6th Edition, 2001, Sarat Book Distributors, Kolkata.
3. Physical Chemistry, G.M. Barrow, 6th Edition (2007), Tata McGraw Hill Publishing Co. Ltd. New Delhi.
4. The Elements of Physical Chemistry, P.W. Atkins, 2nd Edition, Oxford University Press Oxford. Ltd., Publishers, 2005.
5. Concise Inorganic Chemistry, J.D. Lee, 4th Edn , ELBS
6. Inorganic Chemistry: Principles of Structure and Reactivity, James E. Huheey
7. Organometallic Chemistry: A Unified Approach, Ram Charan Mehrotra, New Age International.
8. Inorganic Chemistry, D. F. Shriver and P. W. Atkins, 3rd edition, Oxford University Press (1999)

#### **SCHE355MNP General Chemistry -III PRACTICAL**

1. Senior Practical Physical Chemistry by B.D. Khosla, V.C. Garg & A. Gulati. R. Chanda and Co., New Delhi (2011)
2. Experiments in Physical Chemistry by C.W. Garland, J.W. Nibler & D.P. Shoemaker. McGraw-Hill New York 8<sup>th</sup> Edition (2003)
3. Vogel's Textbook of Quantitative Chemical Analysis. Pearson Publication



**SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)**

<b>Programme: Sciences CHEMISTRY MINOR</b>	<b>Semester – 6</b>
<b>Course Title: General Chemistry-IV</b>	<b>Course Code: SCHE366MN</b>
<b><u>COURSE OBJECTIVES:</u></b> 1. To explain the basic principles involved in organic reactions and their mechanisms 2. To introduce aromaticity and spectroscopic principles	
<b><u>COURSE OUTCOMES:</u></b> The learner will be able to : 1. predict the product name of the compounds and write the mechanism, arrange in the order of stability reaction intermediates, 2. identify aromatic, non-aromatic and anti aromatic compounds. Understand the basics of spectroscopic techniques	

<b>Theory Lectures per week (1 Lecture is 60 minutes)</b>	<b>1</b>		
<b>Total number of Hours in a Semester</b>	<b>15</b>		
<b>Credits</b>	<b>1</b>		
<b>Evaluation System</b>	<b>Summative Assessment</b>	<b>1 Hour</b>	<b>25 marks</b>
	<b>Continuous Assessment</b>	<b>--</b>	<b>-</b>



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UNIT 1 (1 Credit)	<b>1.1</b>	<b>Basics of organic reactions</b> 1.1.1. Basics terms and concepts: Bond fission, reaction intermediates, electrophiles and nucleophiles, ligand, base, electrophilicity vs. acidity and nucleophilicity vs basicity. Types of reactions - addition elimination, substitution 1.1.2. Investigation of reaction mechanisms: Product analysis including cross-over products, trapping of intermediates, isotopic labeling, kinetic and stereochemical evidence.	15 hours
	<b>1.2</b>	<b>Introduction to Aromaticity</b> 1.2.1 Criteria for aromaticity (Hückel's rule), antiaromaticity, aromatic character of arenes, cyclic carbocations /carbanions (examples using C3-C7 atoms) 1.2.2 The nomenclature of Benzene, Naphthalene and anthracene contain different functional groups. (2L) 1.2.3 Reactions of aromatic compounds- Electrophilic substitution (mechanism expected) and Nucleophilic substitution.	
	<b>1.3</b>	<b>Introduction to spectroscopy</b> 1.3.1 Principles of spectroscopic techniques: Microwave, Infrared, UV Visible and Nuclear Magnetic Resonance. 1.3.2 Interpretation of spectra : UV and IR, NMR	

<b>PRACTICAL</b>  <b>General Chemistry-IV</b>	<b>SEMESTER 6</b>  <b>Course Code: SCHE366MNP</b>
<b><u>COURSE OBJECTIVE:</u></b> To understand the method and concept of separation of a binary mixture quantitatively by physical and chemical method	
<b><u>COURSE OUTCOME:</u></b> The learner will be able to identify the nature of a binary mixture and separate the mixture quantitatively.	



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<b>Lectures per week (1 Lecture is 120 minutes)</b>		<b>1</b>	
<b>Total number of Hours in a Semester</b>		<b>30</b>	
<b>Credits</b>		<b>1</b>	
<b>Evaluation System</b>	<b>Summative Assessment</b>	<b>3 Hours</b>	<b>25marks</b>
	<b>Continuous Assessment</b>	--	

		<p><b>Separation of Binary solid-solid mixture (2.0 gms mixture to be given)</b>-Minimum eight mixtures</p> <p>a. Components of the mixture should include water soluble and water insoluble acids (carboxylic acid), water insoluble phenols( 2-naphthol, 1-naphthol), water insoluble bases (nitroanilines) , water soluble neutral (thiourea, urea) and water insoluble neutral compounds (anilides , amide)</p> <p>b.After correct determination of chemical type, the separating reagent should be decided by the student for separation. Follow separation scheme with the bulk sample of binary mixture.</p> <p>c.After separation into component A and component B, physical constants of both components have to be determined.</p>	30 hours
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**ASSESSMENT DETAILS:**

1. Continuous assessment (CA): Any one activity / assignment of 25 marks One Test 25 marks
2. Summative assessment (SA): Theory exam of 50 marks – Two hour duration
3. Summative assessment (SA: Practical exam of 50 marks – Three hours duration



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**REFERENCES:**

**SCHE366MN General Chemistry -IV THEORY**

1. Organic Chemistry, J. Claydens, N. Greeves, S. Warren and P. Wothers, Oxford University Press.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Part A, page no. 713-769, and B, Plenum Press.
3. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure, Michael B. Smith, Jerry March, Wiley.
4. Organic Chemistry, R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, Pearson Publication (7th Edition)
5. Introduction to Spectroscopy, Donald L. Pavia, Gary M. Lampman, George S. Kriz, Thomson Brooks.
6. Spectrometric Identification of Organic Compounds, R. Silverstein, G.C Bassler and T.C. Morrill, John Wiley and Sons

**SCHE366MNP General Chemistry -IV PRACTICAL**

1. Systematic Qualitative organic analysis, H. Middleton (Orient Longman)
2. A Handbook of Organic Analysis, H.T. Clark (Orient Longman)
3. Systematic Identification of organic compounds, R.L. Shriner (John Wiley, New York)