

# **Shri Rawatpura Sarkar University, Raipur**



## **Examination Scheme & Syllabus**

**for**

**Three Year Bachelor of Science  
(Hons.) in Chemistry Programme**

**B.Sc. (Hons.) Chemistry Semester-I**

**(Effective from the session: 2022-23)**



# Shri Rawatpura Sarkar University

## Raipur, Chhattisgarh

### Department of Chemistry

### Faculty of Science

## Program Outcome

- PO1 : Critical Thinking:** Ability to take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives
- PO2 : Effective Communication:** Ability to speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology
- PO3 : Effective Citizenship:** Ability to demonstrate empathetic social concern and equity-centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering
- PO4 : Environment and Sustainability:** Ability to understand the issues of environmental contexts and sustainable development
- PO5 : Ethical Living:** Ability to recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them
- PO6 : Social Interaction:** Ability to elicit views of others, mediate disagreements and help reach conclusions in group settings
- PO7 : Problem Solving and Analytical Skills:** Ability to think rationally, analyze situations and solve problems adequately

## Program Specific Outcome

- PSO1** : Work in the interdisciplinary and multidisciplinary areas of chemical sciences and its applications.
- PSO2** : Analyze the data obtained from sophisticated instruments (like FTIR, NMR, GCMS, HPLC, GCMS UVVis, Fluorescence, and TGA) for the structure determination and chemical analysis.
- PSO3** : Apply green/sustainable chemistry approach towards planning and execution of research in frontier areas of chemical sciences.
- PSO4** : Have sound knowledge about the fundamentals and applications of chemical and scientific theories
- PSO5** : Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.
- PSO6** : Helps in understanding the causes of environmental pollution and can open up new methods for environmental pollution control.
- PSO7** : Acquires the ability to synthesize, separate and characterize compounds using laboratory and instrumentation techniques.
- PSO8** : Carry out experiments in the area of organic analysis, estimation, separation, derivative process, inorganic semi micro analysis, preparation, conductometric and potentiometric analysis
- PSO9** : Learns about the potential uses of analytical industrial chemistry, medicinal chemistry and green chemistry.
- PSO10** : Understands the background of organic reaction mechanisms, complex chemical structures, and instrumental method of chemical analysis, molecular rearrangements and separation techniques.



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**Raipur, Chhattisgarh**  
**Department of Chemistry**  
**Faculty of Science,**

**Three Year Bachelor of Science (Hons.) in Chemistry Programme**  
**B.Sc. (Hons.) Chemistry Semester-I**  
**Scheme of Teaching and Examination**

**Outcome Based Education (OBC) and Choice Based Credit System (CBCS)**  
(Effective from the session: 2022-2023)

S. No.	Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Sem End Exam Duration (Hrs)
			L	T	P		Continuation Evaluation	Semester End Examination	Total	
1	SSH02101T	Physical Chemistry-I	4	-	-	4	30	70	100	3.0
2	SSH02102T	Organic Chemistry-II	4	-	-	4	30	70	100	3.0
3	SSH02112T	Environmental Science	4	-	-	4	30	70	100	3.0
4	SSH02152T	Generic Elective II	4	-	-	4	30	70	100	3.0
5	SSH02181T	Chemistry Lab Course: III	-	-	4	2	15	35	50	5.0
6	SSH02182P	Chemistry Lab Course: IV	-	-	4	2	15	35	50	5.0
7	SSH02183P	Generic Elective: Lab II	-	-	4	2	15	35	50	5.0
<b>Total teaching hrs/week: 28</b>			<b>Total Credits</b>			<b>22</b>	<b>Total Marks</b>		<b>550</b>	

**Generic Electives (Semester I to IV): Zoology, Bioscience, Maths and Physics**

<b>Semester:</b>	Semester I	Semester II	Semester III	Semester IV
<b>Subject:</b>	Zoology I	Zoology II	Bioscience I	Bioscience II
	Maths I	Maths II	Physics I	Physics II



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<b>Course Title</b>	<b>Inorganic Chemistry-I</b>				
<b>Course Code</b>	<b>SSH02101T</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>4</b>	<b>-</b>	<b>-</b>	<b>4</b>	
<b>Prerequisites</b>	<b>BASIC CHEMISTRY</b>				
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>To understand the basics of inorganic chemistry</li> </ul>				
<b>Course Contents</b>	<p><b>UNIT -I</b></p> <p><b>Atomic Structure</b> Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of <math>\psi</math> and <math>\psi^2</math>. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.</p> <p><b>UNIT -II</b></p> <p><b>Periodicity of Elements:</b> s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block. Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table, Atomic radii (van der Waals), Ionic and crystal radii., Covalent radii (octahedral and tetrahedral), Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy, Electron gain enthalpy, trends of electron gain enthalpy, Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.</p> <p><b>UNIT -III</b></p> <p><b>Ionic bond:</b> General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.</p> <p><b>Metallic Bond:</b> Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.</p> <p><b>UNIT- IV</b></p> <p><b>Covalent bond:</b> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid</p>				



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	<p>orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N<sub>2</sub>, O<sub>2</sub>, C<sub>2</sub>, B<sub>2</sub>, F<sub>2</sub>, CO, NO, and their ions; HCl, BeF<sub>2</sub>, CO<sub>2</sub>, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (<math>\sigma</math> and <math>\pi</math> bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.</p> <p><b>UNIT -V</b></p> <p><b>Weak Chemical Forces:</b> van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution process. <b>Oxidation-Reduction:-</b> Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.</p>
<b>Course Outcomes</b>	<ul style="list-style-type: none"><li>• On the completion of this course successfully student will be able to</li></ul> <p>CO 1 : Understand the structure of atom and dual nature of electron</p> <p>CO 2 : Define the structure and shape of molecules on the basis of VSEPER theory</p> <p>CO 3 : Students will be able to know the inductive effect, hyperconjugation and resonance of molecule</p> <p>CO 4 : Students will be capable to understand the reaction mechanism in organic chemistry</p> <p>CO 5 : Students will be suitable to understand the oxidation reduction of molecules.</p>
<b>Text Books</b>	<ol style="list-style-type: none"><li>1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.</li><li>2. Douglas, B.E. and McDaniel, D.H. Concepts &amp; Models of Inorganic Chemistry Oxford, 1970</li></ol>
<b>Reference Books</b>	<ol style="list-style-type: none"><li>1. Atkins, P.W. &amp; Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.</li><li>2. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.</li></ol> <p>Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.</p>



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<b>Course Title</b>	<b>Organic Chemistry: I</b>				
<b>Course Code</b>	SSH02102T				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	4	-	-	4	
<b>Prerequisites</b>	<b>BASIC ORGANIC CHEMISTRY</b>				
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>Understand the basic knowledge of basics of organic chemistry</li> </ul>				
<b>Course Contents</b>	<p><b>UNIT -I</b></p> <p><b>Basics of Organic Chemistry:</b> Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophilicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.</p> <p><b>UNIT -II</b></p> <p><b>Stereochemistry:</b> Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis-trans and, syn-anti isomerism E/Z notations with C.I.P rules, Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.</p> <p><b>UNIT -III</b></p> <p><b>Carbon-Carbon sigma bonds:-</b> Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity, <b>Carbon-Carbon pi bonds:-</b>Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations, <b>Cycloalkanes and Conformational Analysis:</b> Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams</p> <p><b>UNIT -IV</b></p> <p><b>Reactions of alkenes:</b> Electrophilic additions their mechanisms (Markownikoff/Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and</p>				



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	<p>anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene, <b>Reactions of alkynes</b>: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.</p> <p><b>UNIT- V</b></p> <p><b>Aromatic Hydrocarbons</b>: Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.</p>
<b>Course Outcomes</b>	<p>On the completion of this course successfully student will be able to understand</p> <p>CO 1 : preparation and reaction of organic molecules</p> <p>CO 2 : Stereochemistry, Optical Isomerism</p> <p>CO 3 : Carbon- Carbon bonds in Alkane and Cycloalkane reaction and confirmation analysis.</p> <p>CO 4 : Reaction of Alkenes and Alkynes</p> <p>CO 5 : Aromaticity</p>
<b>Text Books</b>	<ol style="list-style-type: none"><li>1. Graham Solomon, T.W., Fryhle, C.B. &amp; Snyder, S.A. Organic Chemistry, John Wiley &amp; Sons (2014).</li><li>2. McMurry, J.E. Fundamentals of Organic Chemistry, 7<sup>th</sup> Ed. Cengage Learning India Edition, 2013.</li><li>3. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).</li><li>4. Morrison, R. N. &amp; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).</li></ol>
<b>Reference Books</b>	<ol style="list-style-type: none"><li>1. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).</li><li>2. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).</li><li>3. Eliel, E. L. &amp; Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.</li><li>4. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.</li></ol>





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<b>Course Title</b>	<b>English Language</b>			
<b>Course Code</b>	<b>SSH02111T</b>			
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>
	2	-	-	2
<b>Prerequisites</b>	<b>Basic knowledge of English</b>			
<b>Course Objectives</b>	<p><b>Upon completion of the course the student shall be able to</b></p> <ol style="list-style-type: none"> <li>1. Communicate effectively (Verbal and Non Verbal)</li> <li>2. Effectively manage the team as a team player</li> <li>3. Develop interview skills</li> </ol>			
<b>Course Contents</b>	<p><b>UNIT I</b></p> <p><b>Key Concepts:</b> Process and Elements of Communication: context of communication; the speaker/writer and the listener/reader; Medium of communication; Principles of communication (7 C's of communication); Barriers in communication, effective communication; Communication in organization.</p> <p><b>UNIT II</b></p> <p><b>Writing:</b> Selecting material for expository, descriptive, and argumentative pieces; Resume; covering letter, Elements of letter writing and style of writing, business letters: Quotation and Tenders; Basics of Informal and Formal Reports-technical report writing, lab report; Précis writing.</p> <p><b>UNIT III</b></p> <p><b>Reading:</b> Effective Reading; reading different kinds of texts for different purposes; reading between the lines. Comprehension of Unseen Passages. Grammar in use: Errors of Accidence and syntax with reference to Parts of Speech; Agreement of Subject and Verb; Tense and Concord; Use of connectives, Question tags. Voice and Narration. Indianism in English: Punctuation and Vocabulary, Building (Antonym, Synonym, Verbal Analogy and One Word Substitution).</p> <p><b>UNIT IV</b></p> <p><b>Speaking:</b> Achieving desired clarity and fluency; effective speaking; task-oriented, inter-personal, informal and semi-formal speaking Meetings, Seminar, Conferences, Interviews, Presentation, Audio-visual communication.</p> <p><b>UNIT V</b></p> <p><b>Listening:</b> Achieving ability to comprehend material delivered at relatively fast speed; comprehending spoken material in Standard Indian English, British English and American English; Intelligent listening in situations. Advantages of listening. Hearing and Listening; Essentials of Good Listening. Use of Modern</p>			



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	Communication Devices; Telephonic Conversation.
<b>Course Outcomes</b>	<p style="text-align: center;">On the completion of this course successfully student will be able to</p> CO 1 : Understand Process and Elements of Communication CO 2 : Gain knowledge Formal Reports-technical report writing, lab report; Précis writing. CO 3 : Learn the Effective Reading, Voice and Narration CO 4 : Learn about the effective speaking, inter-personal, informal and semi-formal speaking CO 5 : Hearing and Listening, Use of Modern Communication Devices
<b>Text Books</b>	<ol style="list-style-type: none"><li>1. Sharma RC &amp; Mohan K – "Business Corresponding and Report Writing", Tata McGraw Hill, New Delhi, 1994.</li><li>2. Alok Jain, P S Bhatia &amp; A M Shiekh – "Professional Communication Skills; S. Chand &amp; Company Ltd. 2005.</li><li>3. Rajendra Pal and JS Korlahalli – "Essentials of Business Communication", Sultan Chand &amp; Sons, 1997.</li><li>4. A guide to Correct English – Oxford University Press, Ely House, London W.I., Latest Edition. (For UNITIII)</li><li>5. Fiske, john – "Introduction to Communication Studies", Rotledge London,1990.</li></ol>
<b>References Books</b>	<ol style="list-style-type: none"><li>1. Geoffrey Leech &amp; Jan Svartvik – "A Communicative Grammar of English", ELBS Longman, England.</li><li>2. Bill Scott – "The Skills of Communicating", Jaico Publishing House, Mumbai,2004.</li><li>3. Gartside L- "Model Business Letters", Pitman, London,1992.</li><li>4. Krishna Mohan &amp; N. P. Singh – "Speaking English Effectively"; MacMillan India, New Delhi; 2001.</li><li>5. 100 Tests in VOCABULARY; Indian Institute of Publishing,Chennai</li></ol>



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<b>Course Title</b>	<b>Zoology : I</b>				
<b>Course Code</b>	<b>SSH02151T</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>4</b>			<b>4</b>	
<b>Prerequisites</b>	<b>BASIC BIOLOGY</b>				
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>To make students familiar with the classification of animals and study about the major classes of Non-chordates.</li> </ul>				
<b>Course Contents</b>	<p><b>UNIT -I</b>  <b>Protista, Parazoa and Metazoa:</b> General characteristics and Classification up to classes Study of Euglena, Amoeba and Paramecium Life cycle and pathogenicity of Plasmodium vivax and Entamoebahistolytica Locomotion and Reproduction in Protista Evolution of symmetry and segmentation of Metazoa</p> <p><b>UNIT- II</b>  <b>Porifera:</b> General characteristics and Classification up to classes Canal system and spicules in sponges;</p> <p><b>UNIT -III</b>  <b>Ctenophora and Cnidaria:</b> Metagenesis in Obelia; Corals and coral reefs. General characteristics and Evolutionary significance</p> <p><b>UNIT -IV</b>  <b>Platyhelminthes:</b> General characteristics and Classification up to classes Life cycle and pathogenicity of Fasciola hepatica and Taeniasolium</p> <p><b>UNIT -V</b>  <b>Nemathelminthes:</b> General characteristics and Classification up to classes Life cycle, and pathogenicity of Ascarislumbricoides and Wuchereriabancrofti Parasitic adaptations in helminthes</p>				
<b>Course Outcomes</b>	<p>On the completion of this course successfully student will be able to</p> <p>CO 1 : Understand Euglena, Amoeba and Paramecium Life cycle</p> <p>CO 2 : Gain knowledge on Porifera Canal system and spicules in sponges</p> <p>CO 3 : Learn the Corals and coral reefs</p> <p>CO 4 : Learn about the Platyhelminthes</p> <p>CO 5 : Parasitic adaptations in helminthes</p>				



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<b>Text Books</b>	<ol style="list-style-type: none"><li>1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.</li><li>2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science</li></ol>
<b>References Books</b>	<ol style="list-style-type: none"><li>1. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S.and Nelson</li></ol>



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<b>Course Title</b>	<b>Maths I: Algebra</b>				
<b>Course Code</b>	<b>SSH02152T</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	<b>4</b>	<b>1</b>		<b>5</b>	
<b>Prerequisites</b>	<b>Basic knowledge of mathematics</b>				
<b>Course Objectives</b>	<p>i) To acquire a basic body of Mathematical knowledge that will provide the students with a strong foundation for further study and/or for a career in Mathematics or in other technical or scientific fields. (ii) To develop fundamental mathematical skill and the ability for independent mathematical learning and reasoning. (iii) To become aware of the applications of mathematics across science and technology, and to learn how to use mathematical ideas and techniques to solve real life problem.</p>				
<b>Course Contents</b>	<p><b>UNIT I</b> Mapping, Types of mapping, Equivalence Relation and Partitions, Congruence Modulo n.</p> <p><b>UNIT II</b> Symmetric, Skew Symmetric, Hermitian and Skew Hermitian matrices, Elementary operations on matrices. Inverse of a matrix. Linear independence of row and column matrices. Row rank, column rank and rank of a matrix. Equivalence of column and row ranks.</p> <p><b>UNIT III</b> Eigen values, Eigen vectors and characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.</p> <p><b>UNIT IV</b> Application of matrices to a system of linear (both homogenous and non homogenous) equations. Theorem on consistency of system of linear equation.</p> <p><b>UNIT V</b> Relation between the roots and coefficient of general polynomial equation in one variable. Transformation of equations. Descartes rules of signs. Solutions of cubic equation (Cardon's method), Biquadratic equation (Ferari's method)</p>				
<b>Course Outcomes</b>	<p style="text-align: center;">On the completion of this course successfully student will be able to</p> <p>CO 1 : Understand Mathematical Concept of the social and natural problems by logic facts</p> <p>CO 2 : Gain knowledge on Algebra helps to present the problems</p>				



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	<p style="text-align: center;">logically for the logical solution</p> <p>CO 3 : Learn the the concept of mapping, matrices</p> <p>CO 4 : Learn about the general polynomial equation</p> <p>CO 5 : Understand the Transformation of equations. Descartes rules of signs</p>
<b>Text Books</b>	<ol style="list-style-type: none"><li>1. I.N. Herstein, Topics in Algebra Wiley Eastern Ltd., New Delhi, 1975</li><li>2. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.</li><li>3. Chandrika Prasad, Text-Book on Algebra and Theory of equations, Pothishala Private Ltd., Allahabad</li><li>4. S.L. Loney, Plane Trigonometry Part II, Macmillan and Company, London.</li><li>5. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.</li></ol>
<b>References Books</b>	<ol style="list-style-type: none"><li>1. K.B. Datta, Matrix an linear algebra, Prentics Hall of India Pvt. Ltd. New Delhi, 2000.</li><li>2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, First Course in linear Algebra, Wiley Eastern, New Delhi, 1983.</li><li>3. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2 edition), Cambridge University Press, Indian Edition, 1997</li><li>4. S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic linear Algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001.</li><li>5. H.S. Hall and S.R. Knight, Higher Algebra, H.M. Publications, 1994.</li><li>6. Chandrika Prasad, Text-Book on Algebra and Theory of Equations, Pothishala Private Ltd., Allahabad.</li><li>7. S.L. Loney, Plane Trigonometry Part II, Macmillan and Company, London</li><li>8. R.S. Verma and K.S. Shukla, Text Book on Trigonometry, Pothishala Pvt. Ltd., Allahaba</li></ol>



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<b>Course Title</b>	<b>Chemistry Lab Course: I</b>				
<b>Course Code</b>	<b>SSH02181P</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	-	-	2	2	
<b>Prerequisites</b>	<b>Inorganic, Physical and Organic Chemistry</b>				
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>To enable the students to develop skills inorganic, physical and organic chemistry.</li> </ul>				
<b>Course Contents</b>	<p><b>Perform any 10 experiment</b></p> <p><b>1. Titrimetric Analysis</b></p> <p>(i) Calibration and use of apparatus</p> <p>(ii) Preparation of solutions of different Molarity/Normality of titrants</p> <p><b>2. Acid-Base Titrations</b></p> <p>(i) Estimation of carbonate and hydroxide present together in mixture.</p> <p>(ii) Estimation of carbonate and bicarbonate present together in a mixture.</p> <p>(iii) Estimation of free alkali present in different soaps/detergents</p> <p><b>3. Oxidation-Reduction Titrimetry</b></p> <p>(i) Estimation of Fe(II) and oxalic acid using standardized <math>\text{KMnO}_4</math> solution.</p> <p>(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.</p> <p>(iii) Estimation of Fe (II) with <math>\text{K}_2\text{Cr}_2\text{O}_7</math> using internal (diphenylamine, anthranilic acid) and external indicator.</p> <p><b>4. Surface tension measurements.</b></p> <p>(i) Determine the surface tension by (i) drop number (ii) drop weight method.</p> <p>(ii) Study the variation of surface tension of detergent solutions with concentration.</p> <p><b>5. Viscosity measurement using Ostwald's viscometer.</b></p> <p>(i) Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature.</p> <p>(ii) Study the variation of viscosity of sucrose solution with the concentration of solute.</p> <p>Any other experiment carried out related to inorganic chemistry and physical chemistry.</p>				
<b>Course Outcomes</b>	On the completion of this course successfully student will be able to				



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	<p>CO 1 : Understand the Titrimetric Analysis</p> <p>CO 2 : Gain knowledge on Acid-Base Titration</p> <p>CO 3 : Understand the concept Oxidation-Reduction Titrimetry</p> <p>CO 4 : Practically performance of Surface tension of water and organic liquid</p> <p>CO 5 : To handle Ostwald's viscometer and determine the viscosity of water and organic liquid</p>
<b>Text Books</b>	<ol style="list-style-type: none"><li>1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. &amp; Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.</li><li>2. Mann, F.G. &amp; Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.</li><li>3. Khosla, B. D.; Garg, V. C. &amp; Gulati, A. Senior Practical Physical Chemistry, R. Chand &amp; Co.: New Delhi (2011).</li><li>4. Ahluwalia, V.K. &amp; Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press.</li></ol>
<b>Reference Books</b>	<ol style="list-style-type: none"><li>1. Khosla, B. D.; Garg, V. C. &amp; Gulati, A. Senior Practical Physical Chemistry, R. Chand &amp; Co. New Delhi (2011).</li><li>2. Garland, C.W.; Nibler, J.W. &amp; Shoemaker, D.P. Experiments in Physical Chemistry 8<sup>th</sup> Ed.; McGraw-Hill: New York (2003).</li><li>3. Halpern, A.M. &amp; Mc Bane, G.C. Experimental Physical Chemistry 3<sup>rd</sup> Ed.; W.H. Freeman &amp; Co.: New York (2003).</li></ol>





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<b>Course Title</b>	<b>Chemistry Lab Course: II</b>			
<b>Course Code</b>	<b>SSH02182P</b>			
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>
	-	-	2	2
<b>Prerequisites</b>	<b>Organic Chemistry</b>			
<b>Course Objectives</b>	<ul style="list-style-type: none"><li>To enable the students to develop practical skills on organic chemistry experiments</li></ul>			
<b>Course Contents</b>	<p><b>Perform any 10 experiment</b></p> <ol style="list-style-type: none"><li>Checking the calibration of the thermometer</li><li>Purification of organic compounds by crystallization using the following solvents:<ol style="list-style-type: none"><li>Water</li><li>Alcohol</li><li>Alcohol-Water</li></ol></li><li>Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)</li><li>Effect of impurities on the melting point – mixed melting point of two unknown organic compounds</li><li>Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)</li><li>Chromatography<ol style="list-style-type: none"><li>Separation of a mixture of two aminoacids by ascending and horizontal paper chromatography</li><li>Separation of a mixture of two sugars by ascending paper chromatography</li><li>Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography(TLC)</li></ol></li><li>pH metry<ol style="list-style-type: none"><li>Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.</li><li>Preparation of buffer solutions of different pH<ol style="list-style-type: none"><li>Sodium acetate-acetic acid</li><li>Ammonium chloride-ammonium hydroxide</li></ol></li></ol></li></ol>			



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	<p>c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.</p> <p>d. Determination of dissociation constant of a weak acid. Any other experiment carried out related to organic chemistry and physical chemistry.</p>
<b>Course Outcomes</b>	<p>On the completion of this course successfully student will be able to</p> <p>CO 1 : Understand the calibration of the thermometer</p> <p>CO 2 : Determination of the melting points of organic molecule.</p> <p>CO 3 : Understand the concept Chromatography</p> <p>CO 4 : Understand the calibration of pH meter</p> <p>CO 5 : Determine the pH of solution by pH meter.</p>
<b>Text Books</b>	<ol style="list-style-type: none"><li>1. Mann, F.G. &amp;Saunders,B.C. Practical Organic Chemistry, Pearson Education (2009)</li><li>2. Furniss, B.S.; Hannaford, A.J.;Smith,P.W.G.; Tatchell,A.R. Practical Organic Chemistry, 5<sup>th</sup> Ed., Pearson(2012)</li></ol>
<b>Reference Books</b>	<ol style="list-style-type: none"><li>1. Ahluwalia, V.K. &amp;Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).Navbodh Practical Book, 2019</li></ol>



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**2022-2023**

<b>Course Title</b>	<b>Zoology Lab Course: I</b>				
<b>Course Code</b>	<b>SSH02182P</b>				
<b>Course Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>TC</b>	
	-	-	2	2	
<b>Prerequisites</b>	<b>ZOOLOGY</b>				
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>To be familiar with the different non chordate and chordate phyla, their general and distinguishing characters.</li> </ul>				
<b>Course Contents</b>	<ol style="list-style-type: none"> <li>Study of whole mount of Euglena, Amoeba and Paramecium, Binary fission and Conjugation in Paramecium.</li> <li>Examination of pond water collected from different places for diversity in protista.</li> <li>Study of Sycon(T.S. and L.S.), Hyalonema, Euplectella, Spongilla.</li> <li>Study of Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora.</li> <li>One specimen/slide of any ctenophore.</li> <li>Study of adult Fasciola hepatica, Taeniasoliumand their life cycles (Slides/microphotographs).</li> </ol>				
<b>Course Outcomes</b>	<p>On the completion of this course successfully student will be able to</p> <p>CO 1 : Understand the Binary fission</p> <p>CO 2 : Examine pond water collected from different places</p> <p>CO 3 : Sycon(T.S. and L.S.), Hyalonema, Euplectella, Spongilla.</p> <p>CO 4 : Study of Obelia, Physalia, Millepora</p> <p>CO 5 : study Taeniasoliumand their life cycles</p>				
<b>Text Books</b>	<ol style="list-style-type: none"> <li>A manual of practical zoology, S. Chand 2018</li> <li>Practical Zoology, Prabodh, 2019</li> </ol>				
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.</li> </ol>				