

**Shiv Chhatrapati Shikshan Sanstha's**  
**Rajarshi Shahu Mahavidyalaya, Latur**  
(Autonomous)



**Structure and Curriculum of Four Year Multidisciplinary  
Degree (Honors/Research) Programme with Multiple  
Entry and Exit option**

**Undergraduate Programme of Science and Technology**  
**B.Sc. (Honors/Research) in Chemistry**

**Board of Studies**  
**in**  
**Chemistry**  
**Rajarshi Shahu Mahavidyalaya, Latur**  
(Autonomous)

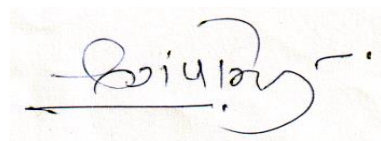
**w.e.f. June, 2023**  
**(In Accordance with NEP-2020)**

## **CERTIFICATE**

I hereby certify that the documents attached are the Bonafide copies of the Curriculum of **B.Sc. (Honors/Research) in Chemistry** Programme to be effective from the **Academic Year 2023-24**.

Date: 14/07/2023

Place: Latur



**Prof. Dhananjay Palke**

Chairperson  
Board of Studies in Chemistry  
Rajarshi Shahu Mahavidyalaya, Latur  
(Autonomous)



## Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

### Members of Board of Studies in the Subject Chemistry Under the Faculty of Science and Technology

Sr. No.	Name	Designation	In position
1	<b>Prof. Dhananjay Palke</b> Head, Department of Chemistry, Rajarshi Shahu Mahavidyalaya (Autonomous), Latur	Chairperson	HoD
2	<b>Prof. Vijay Bhosale</b> Department of Chemistry, Yeshwant Mahavidyalaya, Nanded. Mo.No.9403067252	Member	V.C. Nominee
3	<b>Prof. S. P. Hangiragekar</b> Department of Chemistry, Shivaji University, Kolhapur Mo.No.9890363931	Member	Academic Council Nominee
4	<b>Dr. Babu B. Shingate</b> Department of Chemistry, Dr. B. A. M. U. Aurangabad Mo.No.9850298591	Member	Academic Council Nominee
5	<b>Prof. S. B. Patwari</b> Chemistry, Laal Bhadur Shastri, Mahavidyalaya, Dharmabad Mo.No.9067583746	Member	Expert from outside for Special Course
6	<b>Dr. Pinak M. Chincholkar</b> Springer Nature Technology & Publishing Solutions. Tower 8 and 9 Magarpatta City, Hadapsar. Pune. Mo.No.9823966381	Member	Expert from Industry
7	<b>Dr. R. V. Hangarge</b> Department of Chemistry, Tai Golwalkar Mahavidyalaya, Ramtek. Mo. No. 9075641697	Member	P.G. Alumni
8	<b>Dr. K. I. Momin</b> Assistant Professor, Rajarshi Shahu Mahavidyalaya (Autonomous), Latur-413512	Member	Faculty Member
9	<b>Dr. K. C. Tayade</b> Assistant Professor, Rajarshi Shahu Mahavidyalaya	Member	Faculty Member

<b>Sr. No.</b>	<b>Name</b>	<b>Designation</b>	<b>In position</b>
	(Autonomous), Latur-413512		
<b>10</b>	<b>Mr. M. S. Sudewad</b> Assistant Professor, Rajarshi Shahu Mahavidyalaya (Autonomous), Latur-413512	Member	Faculty Member
<b>11</b>	<b>Dr. K. D. Sawant</b> Department of Botany , Rajarshi Shahu Mahavidyalaya, (Autonomous) Latur 413512	Member	Member from same Faculty

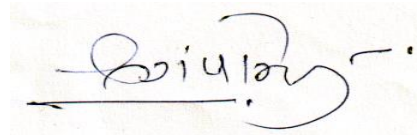
### From the Desk of the Chairperson...

The Department of Chemistry was established in the academic year 1971-72. Need of Chemist, is at the forefront of the noteworthy growth in industries, the college took initiative in starting the B.Sc. Chemistry Program from 1971-72 at Undergraduate (B.Sc.) level. Now, this course is successfully flourishing the need of industries by availing Chemist with sound subject knowledge. Also, Post graduate Program in Chemistry started from Academic Year 2014-2015. From Academic Year 2023-24 we are implementing National Education Policy-2020 (NEP-2020) & Started B.Sc. (Honors/Research) Chemistry Programme to be effective from the same academic year. Department has well equipped laboratories with number of sophisticated instruments. In 2006-07, UGC recognized this department as a “Star Department” in the college and awarded CPE status.

The B.Sc. Chemistry Programme is designed to give sound knowledge and understanding of Chemistry to undergraduate students of the B.Sc. Degree course. The goal of the Programme is to make the study of Chemistry as stimulating, interesting, and relevant as possible. The curriculum is prepared with the aim of making the students capable of studying Chemistry in academic and industrial courses. Also, to expose the students to Chemistry and build up their interest in various fields of chemistry. The new and updated Curriculum is based on National Education Policy-2020 (NEP-2020) Guidelines which includes multiple entries & multiple Exit & interdisciplinary approach with vigor and depth. The curriculum is designed on the basis of Feedbacks & suggestion given by Various Stakeholders and by considering the syllabi of Competitive examination like, IIT-JAM, NET, SET, GATE examinations, UGC model curriculum, syllabi of different entrance examinations and syllabi of other Universities.

Our Vision to evolve as a world class dynamic center of higher education disseminating knowledge rigorously at affordable cost and to emerge as a premier centre that promotes technological competence and democratic values.

- \* “Pursuit of Excellence” in higher education to make our students globally competent.
- \* Enable students to develop as responsible citizens with human values.
- \* Provide value and need based education.
- \* Develop scientific attitude among students.



**Prof. Dhananjay Palke**  
Chairperson  
Board of Studies in Chemistry  
Rajarshi Shahu Mahavidyalaya, Latur  
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## Rajarshi Shahu Mahavidyalaya, Latur

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Faculty of Science and Technology

### Structure for Four Year Multidisciplinary Undergraduate Degree Programme in Chemistry Multiple Entry and Exit (In accordance with NEP-2020)

Year & Level	Sem	Major		Minor	GE/OE	VSC/ SEC (VSEC)	AEC/ VEC	OJT,FP,CEP, RP	Credit per Sem.	Cum./Cr. per exit
		DSC	DSE							
1	2	3		4	5	6	7	8	9	10
I 4.5	I	DSC I: 04 Cr. DSC II: 04 Cr.	NA	NA	GE-I: 04 Cr.	VSC-I: 02 Cr. SEC-I: 02 Cr.	AEC-I MIL: 02 Cr. VEC-I: 02 Cr.	CC-I: 02 Cr. (NSS, NCC, Sports, Cultural)/ CEP-I: 02 Cr. (SES-I)/ OJT: 02 Cr. / Mini Project: 02 Cr.	22	44 Cr. UG Certificate
	II	DSCIII: 04 Cr. DSC IV: 04 Cr. (IKS)	NA	NA	GE-II: 04 Cr.	VSC-II: 02 Cr. SEC-II: 02 Cr.	AEC- II MIL: 02 Cr. VEC- II: 02 Cr.	CC-II: 02 Cr. (NSS, NCC, Sports, Cultural)/ CEP-II: 02 Cr. (SES-II)/ OJT: 02 Cr. / Mini Project: 02 Cr.	22	
	Cum. Cr.	16	-	-	08	04+04= 08	04+02 +02=0 8	04	44	
Exit Option: Award of UG Certificate in Major with 44 Credits and Additional 04 Credits Core NSQF Course/Internship or continue with Major and Minor										

## **Abbreviations:**

1. **DSC : Discipline Specific Core (Major)**
2. **DSE : Discipline Specific Elective (Major)**
3. **DSM : Discipline Specific Minor**
4. **GE/OE : Generic/Open Elective**
5. **VSEC : Vocational Skill and Skill Enhancement Course**
6. **VSC : Vocational Skill Courses**
7. **SEC : Skill Enhancement Course**
8. **AEC : Ability Enhancement Course**
9. **MIL : Modern Indian Languages**
10. **IKS : Indian Knowledge System**
11. **FSRCE : Fostering Social Responsibility & Community Engagement**
12. **VEC : Value Education Courses**
13. **OJT : On Job Training**
14. **FP : Field Projects**
15. **CEP : Community Engagement and Service**
16. **CC : Co-Curricular Courses**
17. **RP : Research Project/Dissertation**
18. **SES : Shahu Extension Services**





## Rajarshi Shahu Mahavidyalaya, Latur

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### Department of Chemistry and Analytical Chemistry

#### B.Sc. (Honors/Research) Chemistry

Year & Level	Semester	Course Code	Course Title	Credits	No. of Hrs.	
I 4.5	I	101CHE1101 (DSC-I)	Inorganic Chemistry-I	03	45	
		101CHE1103	Lab Course-I	01	30	
		101CHE1102 (DSC-II)	Organic Chemistry-II	03	45	
		101CHE1104	Lab Course-II	01	30	
		GE-I	From Basket	04	60	
		101CHE1501 (VSC-I)	Systematic Chemistry Laboratory Techniques (SCLT)	02	45	
		(SEC-I)	From Basket	02	30	
		(AEC-I)	From Basket	02	30	
		(VEC-I)	Constitution of India	02	30	
		AIPC/OJT-I		02	60	
	<b>Total Credits</b>				<b>22</b>	
	II	101CHE2105 (DSC-III)	Physical Chemistry-I	03	45	
		101CHE2107	Lab Course-III	01	30	
		101CHE2106 (DSC-IV) IKS	Roots of Chemistry in Ancient India	03	45	
		101CHE2108	Lab Course-IV	01	30	
		GE-II	From Basket	04	60	
		101CHE2502 (VSC-II)	Basic Concepts in Analytical Chemistry	02	45	
		(SEC-II)	From Basket	02	30	
		(AEC-II)	From Basket	02	30	
		(VEC-II)	FSRCE (CBPR)	02	30	
		AIPC/OJT-II		02	60	
	<b>Total Credits</b>				<b>22</b>	
<b>Total Credits (Semester I &amp; II)</b>				<b>44</b>		



## **Rajarshi Shahu Mahavidyalaya, Latur**

**(Autonomous)**

**Faculty of Science & Technology**

<b>Programme Outcomes (POs) for B.Sc. Programme</b>	
PO 1	
PO 2	
PO 3	
PO 4	
PO 5	
PO 6	
PO 7	



## Rajarshi Shahu Mahavidyalaya, Latur

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<b>Programme Specific Outcomes (PSOs) for B.Sc. Chemistry (Honors/Research)</b>	
<b>PSO No.</b>	Upon completion of this programme the students will be able to
<b>PSO 1</b>	Have firm foundations in the fundamentals and application of current chemical and scientific theories.
<b>PSO 2</b>	integrate their knowledge from each of these areas with critical thinking skills in order to become problem solvers
<b>PSO 3</b>	Be proficient in the chemistry laboratory, especially with respect to the abilities to follow and understand general laboratory practice guidelines, including safety. Perform qualitative & Quantitative chemical analyses. Perform chemical synthesis & Understand and use modern chemical instrumentation.
<b>PSO 4</b>	Find gainful employment in industry or government, be accepted at graduate or professional schools (law, medicine, etc.), or find employment in school systems as instructors or administrators.
<b>PSO 5</b>	Demonstrate a systematic or coherent understanding of the fundamental concepts, principles and processes underlying the academic field of chemistry, its different subfields (analytical, inorganic, organic and physical), and its linkages with related disciplinary areas/subjects;
<b>PSO 6</b>	Demonstrate a procedural knowledge that creates different types of professionals in the field of chemistry and related fields such as pharmaceuticals, chemical industry, teaching, research, environmental monitoring, product quality, consumer goods industry, food products, cosmetics industry, etc.;
<b>PSO 7</b>	Demonstrate a skills related to specialisation areas within chemistry as well as within subfields of chemistry (analytical, inorganic, organic and physical), and other related fields of study, including broader interdisciplinary subfields (life, environmental and material sciences).
<b>PSO 8</b>	Apply appropriate methodologies in order to conduct chemical syntheses, analyses or other chemical investigations; and apply relevant knowledge and skills to seek solutions to problems that emerge from the subfields of chemistry as well as from broader interdisciplinary subfields relating to chemistry;
<b>PSO 9</b>	Use chemical techniques relevant to academia and industry, generic skills and global competencies, including knowledge and skills that enable students to undertake further studies in the field of chemistry or a related field, and work in the chemical and nonchemical industry sectors.
<b>PSO 10</b>	Undertake hands on lab work and practical activities which develop problem solving abilities required for successful career in pharmaceuticals, chemical industry, teaching, research, environmental monitoring, product quality, consumer goods industry, food products, cosmetics industry, etc.



## Rajarshi Shahu Mahavidyalaya, Latur

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Department of Chemistry

Course Type: DSC-I

Course Title: Inorganic Chemistry-I

Course Code: 101CHE1101

Credits: 03

Max. Marks: 75

Lectures: 45 Hrs.

### Learning Objectives:

- LO 1. To understand the fundamental concepts like, Electronic configuration, Pauli's exclusion principle, Hund's rule, Aufbau principle, etc.
- LO 2. To clarify the concepts of Elements and the periodic Table like: Periodicity, Fundamental properties of atoms, Ionization energy, Electron affinity, Electronegativity and its trends in periodic table.
- LO 3. To confront students with periodic Properties of s & p block elements
- LO 4. To Study the spectral & magnetic Properties of Transition Metals

### Course Outcomes:

After completion of course the student will be able to-

- CO 1. Describe the Periodicity, Fundamental properties of atoms, Ionization energy, Electron affinity and Electronegativity.
- CO 2. Describe the periodic Properties of s & p block elements.
- CO 3. Explain the spectral & magnetic Properties of Transition Metals.
- CO 4. Explain types of Bonds and Theories of Chemical Bonding

Unit No.	Title of Unit & Contents	Hrs.
I	<b>Elements and the periodic Table</b>	<b>10</b>
	<ul style="list-style-type: none"><li>1. Electronic configuration: Pauli's exclusion principle, Hund's rule, Aufbau principle and their role in writing the electronic configuration.</li><li>2. Periodicity: Periodic law, arrangement of elements in the periodic table period, group, diagonal relationship in the periodic table.</li><li>3. General properties of atoms: Size of atoms and ions, atomic radii, ionic radii, covalent radii, trends in Periodic table.</li><li>4. Ionization energy: Definition, factors effecting, Inert-pair effect, trends of ionization energy in Periodic table, application to explain the chemical behavior of an atom.</li><li>5. Electron affinity: Definition, factors affecting, trends of electron affinity in Periodic table, application to explain the chemical behavior of an atom.</li><li>6. Electronegativity: Definition, factors affecting, trends of electronegativity in Periodic table, application to explain chemical</li></ul>	

Unit No.	Title of Unit & Contents	Hrs.
	bonding. <b>Unit Outcomes:</b> UO 1. Use the Periodic Table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity. UO 2. Define Ionization energy, Electron affinity and Electronegativity.	
<b>II</b>	<b>S and p- Block Elements</b>	<b>10</b>
	1. Position of the elements in the periodic table 2. Electronic configuration of elements 3. Hydrides of Alkali & Alkaline earth metals 4. Reducing Properties of S-Block elements 5. Anomalous behavior of first member of each group in P-Block elements 6. Atomic and Ionic Size 7. Ionization energy 8. Electronegativity 9. Oxidation state Bonding and shapes of $P_4O_{10}$ , Diamond, Fullerene, Graphite.	
	<b>Unit Outcome:</b> UO 1. Tabulate properties of s & p block elements. UO 2. Identify the different allotropes of carbon.	
<b>III</b>	<b>d- Block Elements</b>	<b>10</b>
	1. Definition, Elements of first, second and third transition series, Electronic Configuration of first transition series. 2. General characteristics of d-block elements, properties of d-block elements (First transition series) such as: Metallic character. Atomic and ionic radii, Melting and Boiling Points, Ionization enthalpies, Reactivity, Oxidation states, Standard electrode potentials, Reducing properties, Colour of ions, Magnetic properties, Catalytic properties and Complex forming tendency.	
	<b>Unit Outcomes:</b> UO 1. Identify paramagnetic and diamagnetic transition metal compound. UO 2. Differentiate between colored and colorless compounds.	
<b>IV</b>	<b>Chemical Bonding &amp; Acid Base Theories</b>	<b>15</b>
	1. Cause of chemical bonding, types of bonding, octet rule. 2. Ionic bond – Nature of ionic bond, conditions for the formation of ionic compounds, properties of ionic compounds, ion polarization and Fajan's rules. Born Haber cycle 3. Covalent bond – Polar and non – polar covalent bond. Percentage ionic character in a polar covalent bond. Hanny	

Unit No.	Title of Unit & Contents	Hrs.
	<p>and Smyth equation, numericals, properties of covalent, compounds.</p> <p>4. Coordinate bond – Conditions for the formation of coordinate bond, properties of coordinate bond, and properties of coordinate compounds.</p> <p>5. Metallic bond – Nature of metallic bond (electron pool theory), properties of metals.</p> <p>6. Hydrogen bond – Nature of hydrogen bond, properties of hydrogen bonding.</p> <p>7. Vander Waals forces – Types, Nature and origin of Vander Waals forces. Factors affecting the strength of Vander Waals forces. Application of Vander Waals forces.</p> <p>8. Lewis acid and base concept its limitations.</p> <p>9. Hard and soft acids and bases. (Pearson’s classification)</p> <p>10. HSAB Principle.</p> <p>11. Lux-Flood and Solvent Concept</p>	
	<p><b>Unit Outcomes:</b>            UO 1. Define Ionic, Covalent and Co-ordinate bond.            UO 2. Identify Soft acids and bases &amp; Hard acids and bases.</p>	

### Learning Resources:

1. Puri, Sharma, Kalia Text Book Of Inorganic Chemistry, Milestone Publications-
2. W.L. Jolly , Modern Inorganic Chemistry (Mc Graw Hill Book company
3. J.E. Huheey, E.A. Keiter, R.L. Keiter Inorganic Chemistry - By Pearson
4. Gurudeep Raj, Chatwal Anand Advanced Inorganic Chemistry Goel Pub., 1974
5. Satyaprakash, G.D. Tuli, S.K. Basu, R.D.Madan, Advanced Inorganic Chemistry, S chand pulicationin
6. Wilkinson and Cotton, Inorganic Chemistry, Wiley; Third edition
7. J. D. Lee: Fifth Edition, Concise Inorganic Chemistry, Wiley, 2008.
8. Bodie Douglas and DarlMcdaniel: Concepts and Models of Inorganic Chemistry ,Third Edition, Wiley, 1983.
9. Duward Shriver, P. W. Atkins: Inorganic Chemistry, Fifth Edition, Oxford University Press 2002



## Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Chemistry

Course Type: Lab Course

Course Title: Lab Course –I (Based on DSC-I)

Course Code: 101CHE1103

Credits: 01

Max. Marks: 50

Hours: 30

### Learning Objectives

LO 1. To estimate the amount of substance / ions in given mixture by volumetrically

LO 2. To analyze qualitatively two acidic and two basic radicals.

### Course outcomes

After completion of course the student will be able to-

CO 1. Analyze the two acidic and two basic radicals qualitatively

CO 2. Estimate the amount of substances in given mixture by volumetric methods.

Practical No.	Unit
1	Prepare standard $\text{Na}_2\text{CO}_3$ solution. Standardize the given HCl solution and estimate the amount of NaOH in the given solution.
2	Estimate the amount of NaOH and $\text{Na}_2\text{CO}_3$ in the given mixture using standard HCl solution.
3	Estimate the amount of $\text{Fe}^{++}$ and $\text{Fe}^{+++}$ separately in the given mixture using standard $\text{K}_2\text{Cr}_2\text{O}_7$ solution.
4	Estimate the amount of $\text{Cu}^{++}$ in the given solution using standard $\text{Na}_2\text{S}_2\text{O}_3$ solution.
5	Find out the strength of supplied $\text{AgNO}_3$ solution using standard $\text{AgNO}_3$ solution. $\text{NH}_4\text{SCN}$ as link solution (Volhard's method).
6	Find out the strength of supplied NaCl solution using standard NaCl and $\text{AgNO}_3$ as link solution (Mohr's method).
7	<b>Inorganic Qualitative analysis</b> Qualitative analysis with two acidic radicals and two basic radicals in the form of mixture (Minimum five mixtures) containing one interfering radical: <b>Acidic radicals:</b> Carbonate, Chloride, Bromide, Iodide, Nitrate, Sulphate. <b>Basic radicals:</b> Copper, Bismuth, Ferric, Aluminum, Manganese, Nickel, Zinc, Barium, Calcium, Magnesium, Ammonium, Potassium.

N.B.: Any Ten Practicals from above.



## Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Chemistry

Course Type: DSC-II

Course Title: Organic Chemistry-II

Course Code: 101CHE1102

Credits: 03

Max. Marks: 75

Lectures: 45 Hrs.

### Learning Objectives

- LO 1. To clarify the concept of IUPAC nomenclature and structure of organic compound
- LO 2. To gain the knowledge of different types of reactions and their mechanism
- LO 3. To understand the preparation and properties of saturated unsaturated and aromatic hydrocarbons
- LO 4. To determine the Saponification value, Iodine value and Acid value of fats and oil

### Course outcomes

After completion of course the student will be able to-

- CO 1. Write the IUPAC name of any organic compounds from their structure and draw its structure from its IUPAC name
- CO 2. Identify the types of reactions and write its mechanism
- CO 3. Explain the preparation and properties of saturated, unsaturated and aromatic hydrocarbons
- CO 4. Determine the Saponification value, Iodine value and Acid value of fats and oil

Unit No.	Title of Unit & Contents	Hrs.
I	<b>Nomenclature of Organic Compounds &amp; Introduction to Reaction Mechanism</b>	11
	<ol style="list-style-type: none"><li>1. Development of organic chemistry, unique properties of organic compound</li><li>2. Functional groups and types of organic compounds, Basic rules of IUPAC nomenclature, Nomenclature of mono- and bi-functional 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</li><li>3. Substrate and Reagents, Electrophiles &amp; Nucleophiles</li><li>4. Homolytic and Heterolytic process of bond fission.</li><li>5. Inductive effect &amp; its Types Mesomeric Effect Hyperconjugation Steric effect</li></ol>	



Unit No.	Title of Unit & Contents	Hrs.
	<p>6. Formation and Stability of reactive intermediates: Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes &amp; Arynes</p> <p>7. Types of organic reactions: Substitution, Addition, Elimination and Rearrangement.</p> <p><b>Unit Outcome:</b>            UO 1. Describe the rules of IUPAC Nomenclature.            UO 2. Write the IUPAC name of any organic compounds.            UO 3. Define reaction intermediates.</p>	
<b>II</b>	<b>Hydrocarbons - I</b>	<b>12</b>
	<p><b>1. Alkanes:</b>            Introduction, Methods of formation of alkanes by            i. Kolbe's electrolytic method            ii. Frankland reaction            Chemical Properties: halogenation (mechanism), nitration (mechanism).</p> <p><b>2. Cycloalkanes:</b>            Introduction, Formation of cycloalkanes by Freund's method            Concept of angle strain, stability and reactivity of cycloalkanes: Bayer's strain theory.            Ring opening reaction with H<sub>2</sub> &amp; HI.</p> <p><b>3. Alkenes:</b>            Introduction            Methods of formation by:            i. dehydration of alcohols (with mechanism)            ii. dehydrohalogenation of alkyl halides (with mechanism).            Chemical Reactions: (with mechanism)            i. Electrophilic addition of Br<sub>2</sub> to ethene            ii. Free radical addition of HBr to propene (Peroxide effect)</p> <p><b>Unit Outcome:</b>            UO 1. Classify organic compounds by structure.            UO 2. Predict the products of reactions of alkenes and describe the mechanisms showing how the products are formed.</p>	
<b>III</b>	<b>Hydrocarbons - II</b>	<b>11</b>
	<p><b>1. Dienes:</b>            a. Introduction &amp; classification of dienes            b. Resonance &amp; M.O. structure of 1, 3 – butadiene            c. Formation of 1, 3 – butadiene from 1, 4 – butanediol            d. Chemical properties:            i. Addition of H<sub>2</sub> &amp; H<sub>2</sub>O on 1,3-butadiene            ii. Diels – Alder reaction</p> <p><b>2. Alkynes:</b>            a. Introduction            b. Methods of formation of acetylene (ethyne) from:            i. Iodoform            ii. Hydrolysis of calcium carbide            c. Chemical properties:            i. Electrophilic addition reactions of ethyne with Br<sub>2</sub> &amp;</p>	

Unit No.	Title of Unit & Contents	Hrs.
	<p>HBr (with mechanism) Nucleophilic addition reactions of ethyne with by HCN (with mechanism)</p> <p><b>3. Benzene:</b></p> <p>a. Introduction b. Characteristics of aromatic compounds. c. Kekule structure d. Stability of benzene: resonance and molecular orbital structure of benzene e. Modern theory of aromaticity: f. Huckel's rule &amp; its applications to benzene, naphthalene, anthracene, furan, pyrrole, pyridine, thiophene, cyclohexene, cyclooctatetrene, cyclopropene, cyclopropenyl cation and cyclopentadienyl anion and antiaromaticity. g. Reactions of benzene - Electrophilic substitution reactions (with mechanism), nitration, halogenation, sulphonation, Friedal-craft alkylation and acylation.</p> <p><b>Unit Outcomes:</b></p> <p>UO 1. Correctly represent the structures and bonding of alkynes, and describe the mechanisms for reactions of alkynes and predict the products of such reactions. UO 2. Describe the structure of Benzene and its aromatic nature.</p>	
<b>IV</b>	<b>Halogen Compounds And Fat &amp; Oils</b>	<b>11</b>
	<p><b>1. Vinyl Chloride:</b></p> <p>a. Introduction b. Structure- Molecular orbital &amp; Resonance c. Methods of formation of vinyl chloride from: i. Ethene ii. Ethylene dichloride iii. Ethyne. d. Physical properties of vinyl chloride Chemical Reactions of vinyl Chloride: Addition reactions with Br<sub>2</sub>, HBr.</p> <p><b>2. Halo Arenes:</b></p> <p>a. Introduction structure and stability of chlorobenzene b. Synthesis of chlorobenzene from: i. Hunsdiecker reaction ii. Gattermann reaction c. Chemical reactions of chlorobenzene: i. Electrophilic and nucleophilic substitution reactions.</p> <p><b>3. Oils &amp; Fats:</b></p> <p>Introduction Chemical nature General chemical properties: I. Hydrolysis II. Analysis of Fats and Oils: i) Saponification number</p>	

Unit No.	Title of Unit & Contents	Hrs.
	(Saponification value) ii) Iodine number (Iodine value) iii) Acid value	
	<b>Unit Outcomes:</b> UO 1. Explain Structure and reactions of Vinyl Chloride. UO 2. Determine the Saponification value of Oils and Fats.	

### Learning Resources:

1. S.M. Mukherji, S.P. Singh, R.P. Kapoor (Vol. I & II) Organic chemistry New Age International (P) Ltd., Publishers
2. Organic chemistry by – Jagdamba Singh, L.D.S. Yadav (Vol. I & II), Pragati Prakashan
3. P.L. Soni, A text book of organic chemistry Sultan Chand, 1983
4. K.S. Tewari, S.N. Mehrotra, N.K. Vishnoi. A text book or organic chemistry, Vikas Publishing House
5. Arun Bahl & B.S. Bahl. A text book of organic chemistry S Chand & Company
6. M.K. Jain. Principal of organic chemistry, S. Nagin,
7. Morrison and Boyd. Organic chemistry , Pearson Education
8. Carey. Organic chemistry by Publisher: James M. Smith
9. Jerry March. Advanced Organic chemistry, Wiley
10. P.S. Kalsi. Organic reactions and their mechanism
11. Peter Sykes, A guide book to mechanism in organic chemistry.



## Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Chemistry

**Course Type: Lab Course**

**Course Title: Lab Course –II (Based on DSC-II)**

**Course Code: 101CHE1104**

**Credits: 01**

**Max. Marks: 50**

**Hours: 30**

### Learning Objectives

LO 1. To find out Melting point and boiling point of given organic compounds.

LO 2. To study the Crystallization, sublimation and distillation methods of purification of organic compounds.

### Course outcomes

After completion of course the student will be able to-

CO 1. Determine the Melting point and Boiling point of given Organic Compounds.

CO 2. Purify the given organic compound by recrystallization, sublimation and distillation.

Practical No.	Unit
1	<b>A)</b> Determine the Nature, functional group and physical constant of organic compounds: B-naphthol, benzaldehyde, benzoic acid, p-nitroaniline, acetanilide, nitrobenzene, ethylalcohol and aniline.
2	<b>B)</b> Methods of Purification of organic compounds: a) Recrystallization: Benzoic acid, $\beta$ -naphthol, cinnamic acid, m-nitroaniline and acetanilide b) Sublimation: Naphthalene, camphor. c) Simple distillation: (any one) i) Separate ethanol & water from mixture ii) Separate acetone & water from mixture

N.B.: Any Ten Practicals from above.



## Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Chemistry

Course Type: VSC-I

Course Title: Systematic Chemistry Laboratory Techniques (SCLT)

Course Code:

Credits: 02

Max. Marks: 50

Lectures: 30 Hrs.

### Learning Objectives:

The course covers the broad objectives as to:

- LO 1. Introduce the learners about the basic facilities available in school, college and industrial level chemistry laboratories.
- LO2. Impart knowledge of the basics and structure of organization and management of laboratories.
- LO 3. Train the learners in the operation and maintenance of chemicals & common apparatus used in laboratories.
- LO 4. Familiarize them to develop skills in common laboratory techniques.
- LO 5. Trained them in the procedures of procurement and storage of laboratory equipment, apparatus, glass wares and chemicals.
- LO 6. Enable them to follow appropriate disposal procedures and safety measures required for chemistry laboratories.

### Course Outcomes:

After completion of course the student will be able to-

- CO 1. Knowledge of all commonly used chemicals, glasswares, apparatus, minor equipment etc
- CO 2. Familiarity to cleaning and maintenance of glassware, equipment, apparatus and laboratory.
- CO 3. Understanding of theoretical aspects and working principles of chemistry lab wares.
- CO 4. Preparation of standards solutions, buffer solutions, indicators, common laboratory reagents.
- CO 5. Knowledge to perform some basic experiments.
- CO 6. Knowledge of all safety measures in the chemistry laboratory, proper disposal of chemicals, chemical wastes and other waste materials.
- CO 7. Awareness about the handling of corrosive chemicals, lab accidents, fire extinguishers and other safety means.
- CO 8. Knowledge of computer for proper organization and management of chemistry laboratories, minor electronic equipment, maintain lab record, inventory etc.

Unit No.	Title of Unit & Contents	Hrs.
I	<b>Introduction of Chemistry Lab</b>	<b>05</b>
	a. General introduction of chemistry laboratory, common instruction for safe working in chemical laboratories, b. Lab design, Storage, ventilation, lighting, fume, cupboard, arrangement of store, Safety provisions, c. Organization of practical work,	

	<p>d. Maintenance of laboratory, equipment/apparatus Cleaning of laboratories and preparation room.</p> <p>e. Glass apparatus- Beaker, Test tube, boiling tube, funnel, separating funnel, filtration flask, round bottom flask, flat bottom flask, condenser Liebig flask, watch glass etc. measuring conical or condenser, Petri dish, desiccators.</p>	
	<p><b>Unit Outcomes:</b>          UO 1. Identify various equipments &amp; glasswares.          UO 2. Glasswares handle with care.</p>	
<b>II</b>	<b>Introduction of Lab Apparatus</b>	<b>05</b>
	<p>a. Volumetric Apparatus - Measuring cylinder, burette, pipette, Volumetric flask, etc.</p> <p>b. Miscellaneous apparatus- Buchner funnel, Bunsen burner, burette stand, retort clamp, china dish/evaporating basin, wire gauze, cork borers, filter pumps, crucible, mohr clip, pipe clay triangle, pestle and mortar, spirit lamp, spatulas, thermometer, pH meter/pH paper etc. and laboratory centrifuge.</p> <p>c. Apparatus for heating: Bunsen burner, water bath, oil bath hot plate, sand bath, hot air oven, heating mantle etc. Handling and storage of glass apparatus Kipp's apparatus.</p>	
	<p><b>Unit Outcomes:</b>          UO 1. Read the volume of a particular solution in burette.          UO 2. Use the water bath, oil bath &amp; sand bath for heating.</p>	
<b>III</b>	<b>Solution Preparation</b>	<b>05</b>
	<p>Water as a solvent, types of water, solutions, components of a solution, types of solution, solubility, concentration of solutions: percentage, molarity, normality, molality (in ppm) calculation of masses and volumes for preparation of solutions solids, liquids.</p>	
	<p><b>Unit Outcome:</b>          UO 1. Calculate amount of solute required for the preparation of standard solution of desired concentration.          UO 2. Prepare standard solution of primary standard grade reagent.</p>	
<b>IV</b>	<b>Common Laboratory Techniques</b>	<b>05</b>
	<p>Refluxing: Apparatus with interchangeable ground glass joints (Quick fit), Filtration: Techniques and filter media, filter paper, simple filtration,          Recrystallization: Choice of solvent and precautions with flammable solvents,          Distillation: recovery of solvents through partial distillation, distillation under reduced pressure, and Determination of Boiling Point.</p>	
	<p><b>Unit Outcomes:</b>          UO 1. Recrystallize organic compound in suitable solvent.          UO 2. Separate ethyl alcohol from the mixture of ethyl alcohol &amp; water mixture.</p>	

V	Practicals (Any Five)	10
	1. Handling of common laboratory equipment 2. Calibration of volumetric glassware 3. Weighing of chemicals using analytical balance 4. Preparation of solutions, indicators and reagents. 5. Preparation of buffer solutions and determination of their pH Values. 6. Preparation of some organic compound and determination of their boiling point and melting point. 7. Simple acid-base titration. 8. Preparation of distilled/deionized water. 9. Purification of organic compounds by recrystallization.	

**Learning Resources:**

1. A.I. Vogel. Practical Organic Chemistry.
2. D.V. Jahagirdar, Experiments in chemistry.
3. Dr. O.P. Panday, D.N. Bajpai & Dr. S.Giri, Practical Chemistry, Chand & Company, New Delhi.
4. Day & Underwood, Qualitative analysis: A laboratory manual.
5. O.P. Agarwal. Advanced Practical Organic chemistry.
6. N.K. Vishnoi. Advanced Practical Organic Chemistry.
7. A.I. Vogel. Vogels Qualitative Analysis.
8. A.I. Vogel. Vogels Quantitative Analysis.
9. J.N. Gurutu & R. Kapoor. Advanced Experimental Chemistry Vol I, II, III.
10. Balwantraisatuja. Practical Chemistry, Physical-Inorganic-Organic & Viva Voce.



## **Rajarshi Shahu Mahavidyalaya, Latur**

**(Autonomous)**

**UG First Year**

### **Basket I: Generic/Open Elective (GE/OE)**

**(GEs offered to the Science & Technology students in Sem.-I)**

<b>Sr. No.</b>	<b>BoS Proposing GE/OE</b>	<b>Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Hrs.</b>
1	Commerce	101AAF1401	Mutual Fund Management	04	60
2	Commerce	101MAE1401	Fundamentals of Statistics	04	60
3	English	101ENG1402	English for Science and Technology	04	60
4	Geography	101GEO1401	General Geography	04	60
5	Commerce	101BAI1401	Personal Financial Management	04	60
6	Marathi	101MAR1401	स्पर्धा परीक्षा आणि मराठी भाषा	04	60
7	Political Science	101POL1401	Human Rights	04	60
8	Biotechnology	101BIO1401	Nutrition, Health and Hygiene	04	60
9	Music	101MUS1401	Indian Vocal Classical & Light Music	04	60
10	NCC Studies	101NCC1401	Introduction to NCC	04	60
11	Sports	101SPO1401	Counseling and Psychotherapy	04	60

**Note: Student can choose any one GE from the basket**





## Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

UG First Year

### Basket II: Skill Enhancement Courses (SEC)

(SEC offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing SEC	Code	Course Title	Credits	Hrs.
1	Chemistry	101CHE1601	Pesticides and Green Chemistry	02	30-45
2	Information Technology	101COM1601	Basics of Python Programming	02	30-45
3	Physics	101PHY1601	Physics Workshop Skills	02	30-45
4	Biotechnology	101BIO1601	Food Processing Technology	02	30-45
5	Botany	101BOT1601	Mushroom Cultivation Technology	02	30-45
6	English	101ENG1601	Proof Reading and Editing	02	30
7	Information Technology	101COA1601	PC Assemble and Installation	02	30-45
8	Marathi	101MAR1601	कथा/पटकथालेखन	02	30
9	Zoology	101ZOO1601	Bee Keeping	02	30-45

**Note: Student can choose any one SEC from the basket**



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**(Autonomous)**

**UG First Year**

**Basket III: Ability Enhancement Courses (AEC)**

**(AEC offered to the Science & Technology students in Sem.-I)**

Sr. No.	BoS Proposing AEC	Code	Course Title	Credits	Hrs.
1	Marathi	101MAR7101	भाषिक कौशल्य भाग - १	02	30
2	Hindi	101HIN7101	हिंदी भाषा शिक्षण भाग - १	02	30
3	Sanskrit	101SAN7101	व्यावहारीक व्याकरण व नितिसुभाषिते	02	30
4	Pali	101PAL7101	उपयोजित व्याकरण	02	30

**Note: Student can choose any one AEC from the basket.**



## **Rajarshi Shahu Mahavidyalaya, Latur**

**(Autonomous)**

**UG First Year**

### **Extra Credit Activities**

<b>Sr. No.</b>	<b>Course Title</b>	<b>Course Code</b>	<b>Credits</b>	<b>Hours T/P</b>
1	MOOCs		Min. of 02 credits	Min. of 30 Hrs.
2	Certificate Courses		Min. of 02 credits	Min. of 30 Hrs.
3	IIT Spoken English Courses		Min. of 02 credits	Min. of 30 Hrs.

### **Guidelines:**

#### **Extra -academic activities**

1. All extra credits claimed under this heading will require sufficient academic input/contribution from the students concerned.
2. Maximum 04 extra credits in each academic year will be allotted.
3. These extra academic activity credits will not be considered for calculation of SGPA/CGPA but will be indicated on the grade card.

#### **Additional Credits for Online Courses:**

1. Courses only from SWAYAM and NPTEL platform are eligible for claiming credits.
2. Students should get the consent from the concerned subject Teacher/Mentor/Vice Principal and Principal prior to starting of the course.
3. Students who complete such online courses for additional credits will be examined/verified by the concerned mentor/internal faculty member before awarding credits.
4. Credit allotted to the course by SWAYAM and NPTEL platform will be considered as it is.

#### **Additional Credits for Other Academic Activities:**

1. One credit for presentation and publication of paper in International/National/State level seminars/workshops.
2. One credit for measurable research work undertaken and field trips amounting to 30 hours of recorded work.
3. One credit for creating models in sponsored exhibitions/other exhibits, which are approved by the concerned department.
4. One credit for any voluntary social service/Nation building exercise which is in collaboration with the outreach center, equivalent to 30 hours
5. All these credits must be approved by the College Committee.

### **Additional Credits for Certificate Courses:**

1. Students can get additional credits (number of credits will depend on the course duration) from certificate courses offered by the college.
2. The student must successfully complete the course. These credits must be approved by the Course Coordinators.
3. Students who undertake summer projects/ internships/ training in institutions of repute through a national selection process, will get 2 credits for each such activity. This must be done under the supervision of the concerned faculty/mentor.

### **Note:**

1. The respective documents should be submitted within 10 days after completion of Semester End Examination.
2. No credits can be granted for organizing or for serving as office bearers/ volunteers for Inter-Class / Associations / Sports / Social Service activities.
3. The office bearers and volunteers may be given a letter of appreciation by the respective staff coordinators. Besides, no credits can be claimed for any services/activities conducted or attended within the college.
4. All claims for the credits by the students should be made and approved by the mentor in the same academic year of completing the activity.
5. Any grievances of denial/rejection of credits should be addressed to Additional Credits Coordinator in the same academic year.
6. Students having a shortage of additional credits at the end of the third year can meet the Additional Credits Coordinator, who will provide the right advice on the activities that can help them earn credits required for graduation.



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### Examination Framework

#### Theory:

40% Continuous Assessment Tests (CATs) and 60% Semester End Examination (SEE)

#### Practical:

50% Continuous Assessment Tests (CATs) and 50% Semester End Examination (SEE)

Course	Marks	CAT & Mid Term Theory				CAT Practical		Best Scored CAT & Mid Term	SEE	Total
		3				4				
1	2	Att.	CAT I	Mid Term	CAT II	Att.	CAT	5	6	5 + 6
DSC/DSE/GE/OE/Minor	100	10	10	20	10	-	-	40	60	100
DSC	75	05	10	15	10	-	-	30	45	75
Lab Course/AIPC/OJT/FP	50	-	-	-	-	05	20	-	25	50
VSC/SEC/AEC/VEC/CC	50	05	05	10	05	-	-	20	30	50

#### Note:

1. All Internal Exams are compulsory
2. Out of 02 CATs best score will be considered
3. Mid Term Exam will be conducted by the Exam Section
4. Mid Term Exam is of Objective nature (MCQ)
5. Semester End Exam is of descriptive in nature (Long & Short Answer)
6. CAT Practical (20 Marks): Lab Journal (Record Book) 10 Marks, Overall Performance 10 Marks.