

**Holy Cross College (Autonomous), Nagercoil**  
Kanyakumari District, Tamil Nadu.  
Accredited with A<sup>+</sup> by NAAC - IV cycle – CGPA 3.35

Affiliated to

**Manonmaniam Sundaranar University, Tirunelveli**



**Semester I & II**

**Guidelines & Syllabus**

**DEPARTMENT OF CHEMISTRY**



**2023-2026**

**(With effect from the academic year 2023-2024)**

**Issued from**

**THE DEANS' OFFICE**

### Vision

- Impart quality education, scientific skills, academic excellence, research attitude and skills to face global challenges.

### Mission

- To develop intellectual and professional skills of the students
- To provide a firm foundation in chemical concepts, laws and theories
- To sharpen the scientific knowledge
- To enhance critical thinking, problem solving ability, scientific temper and innovation
- To apply chemistry in medicine, biology, industry and environment

#### Programme Educational Objectives (PEOs)

PEOs	Upon completion of B.A/B.Sc. Degree Programme, the graduates will be able to	Mapping with Mission
PEO 1	apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.	M1& M2
PEO 2	use practical knowledge for developing professional empowerment and entrepreneurship and societal services.	M2, M3, M4 & M5
PEO 3	pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.	M3, M4, M5 & M6

#### Programme Outcomes (POs)

POs	Upon completion of B.Sc. Degree Programme, the graduates will be able to:	Mapping with PEOs
PO1	obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.	PEO1
PO2	create innovative ideas to enhance entrepreneurial skills for economic independence.	PEO2
PO3	reflect upon green initiatives and take responsible steps to build a sustainable environment.	PEO2
PO4	enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career.	PEO1 & PEO3
PO5	communicate effectively and collaborate successfully with peers to become competent professionals.	PEO2 & PEO3
PO6	absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	PEO2 & PEO3
PO7	participate in learning activities throughout life, through self-paced and self-directed learning to improve knowledge and skills.	PEO1 & PEO3

### Programme Specific Outcomes (PSOs)

PSOs	Upon completion of B.Sc Chemistry programme, the graduates will be able to:	Mapping with POs
PSO - 1	understand the fundamentals, theories and principles of organic, inorganic and physical chemistry.	PO1
PSO - 2	analyze physical and chemical properties of chemical compounds and their uses.	PO1& PO7
PSO - 3	interpret the mechanism of various chemical reactions.	PO3 &PO4
PSO - 4	synthesize organic and inorganic compounds using classical and modern methods.	PO2
PSO - 5	design and carry out scientific experiments, record and interpret the results with accuracy	PO1& PO4
PSO - 6	use concepts, tools and techniques related to chemistry to other branches of science.	PO5
PSO - 7	develop skills in the safe-handling of chemicals and their usage in day today life.	PO1&PO7
PSO - 8	develop entrepreneurial skills, empowered to fulfil the professional requirement and become self-dependent.	PO2& PO6

### Mapping of PO'S and PSO'S

POs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
PO1	S	S	S	S	S	S	S	S
PO2	S	S	M	M	S	S	M	S
PO3	M	M	M	S	S	S	S	S
PO4	S	S	S	M	M	S	M	M
PO5	S	M	M	M	S	S	S	S
PO6	M	M	M	M	S	S	S	S
PO7	S	S	S	S	S	S	S	S

### Eligibility Norms for Admission

#### Eligibility: 10 + 2 pattern

Those who seek admission to B.Sc. Chemistry Course must have passed the Higher Secondary Examinations conducted by the Board of Higher Secondary Examinations, Tamil

Nadu with Chemistry, Physics and Mathematics/Biology subjects or examination recognized and approved by the Syndicate of Manonmaniam Sundaranar University, Tirunelveli.

**Duration of the Programme:** 3 years

**Medium of Instruction:** English

**Passing Minimum**

A minimum of 40% in the external examination and an aggregate of 40% is required. There is no minimum pass mark for the continuous internal assessment.

**Components of B.Sc Chemistry**

**Part III (Core Courses and Elective Courses)**

<b>Core Courses</b>	Core-Theory papers	10 x 100	1000
	Core Project	1x100	100
	Core Practical	5 x 100	500
	Discipline Specific Elective-Theory Papers	3 x 100	300
	<b>Total Marks</b>		<b>1900</b>
<b>Elective Courses</b>	Theory	4 x 100	400
	Practical	4 x 100/ 2x100*	400/200*
	<b>Total Marks</b>		<b>800/600*</b>
	<b>Total Marks</b>		<b>2700/2500*</b>

\*Mathematics Elective

- Core and Elective Practical Courses carry 100 marks each.
- Practical examination will be conducted at the end of each semester for Core and Elective Courses.

**Course Structure**

**Distribution of Hours and Credits**

**Curricular Courses**

Course	S I	S II	S III	S IV	S V	S VI	Total	
							Hours	Credits
<b>Part I</b> –Language	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24	12
<b>Part II</b> -English	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24	12
<b>Part-III</b>								

Core Course	5(5)	5(5)	5(5)	5(5)	5 (4) + 5 (4) + 5 (4) +	6 (5) + 6 (4) + 6 (4) +	75	64
Core Lab Course	3(3)	3(3)	3(3)	3(3)	-	5 (3)		
Core Project					5 (4)			
Elective /Discipline Specific Elective Courses	4 (3) 2(2)	4(3) 2(2)	4 (3) 2(2)	4(3) 2(2)	4 (3) 4(3)	5 (3)	37	29
<b>Part IV</b>								
Non-major Elective Course	2 (2)	2 (2)	-	-	-	-	4	4
Skill Enhancement Course	-	2 (2)	1 (1) 2 (2)	1 (1) 2 (2)	-		8	8
Foundation Course	2(2)	-	-	-	-	-	2	2
Value Education	-	-	-	-	2 (2)	-	2	2
Summer Internship /Industrial Training					(2)			2
Environmental studies	-	-	1	1 (2)	-	-	2	2
Extension activity	-	-	-	-	-	(1)	-	1
Professional Competency Skill						2 (2)	2	2
<b>Total</b>	<b>30 (23)</b>	<b>30 (23)</b>	<b>30 (22)</b>	<b>30 (24)</b>	<b>30 (26)</b>	<b>30 (22)</b>	<b>180</b>	<b>140</b>

### Co-curricular Courses

Course	S I	S II	S III	S IV	S V	S VI	Total
LST (Life Skill Training)	-	(1)	-	(1)			2
Skill Development Training (Certificate Course)	(1)						1
Field Project		(1)					1
Specific Value-added Course	(1)		(1)				2
Generic Value-added Course				(1)		(1)	2
MOOC		(1)		(1)		(1)	3
Student Training Activity: Clubs & Committees / NSS				(1)			1
Community Engagement Activity: RUN				(1)			1
Human Rights Education					(1)		1
Gender Equity Studies						(1)	1
<b>Total</b>							<b>15</b>

Total number of Compulsory Credits = Academic credits + Non-academic credits: 140 + 15

## Courses Offered

### Semester I

Course	Course Code	Title of the Course	Credits	Hours/Week
<b>Part I</b>	TU231TL1	Language: Tamil French	3	6
	FU231FL1			
<b>Part II</b>	EU231EL1	English	3	6
<b>Part III</b>	CU231CC1	Core Course I: General Chemistry – I	5	5
	CU231CP1	Core Lab Course I: Quantitative Inorganic estimation (titrimetry) and Inorganic Preparations	3	3
	CU231EC1	Elective Course I: Chemistry for Biological Sciences – I	3	4
	CU231EP1	Elective Lab Course I : Chemistry Practical for Biological Sciences-Volumetric Analysis	2	2
<b>Part IV</b>	CU231NM1	Non Major Elective NME I: Food Chemistry	2	2
	CU231FC1	Foundation Course: Basics of Chemistry	2	2
<b>Total</b>			<b>23</b>	<b>30</b>

### Semester II

Course	Course Code	Title of the Course	Credits	Hours/Week
<b>Part I</b>	TU232TL1	Language: Tamil French	3	6
	FU232FL1			
<b>Part II</b>	EU232EL1	English	3	6
<b>Part III</b>	CU232CC1	Core Course II: General Chemistry – II	5	5
	CU232CP1	Core Lab Course II: Organic Estimation and Preparation of Organic Compounds	3	3
	CU232EC1	Elective Course II: Chemistry for Biological Sciences – II Botany and Zoology Major	3	4
	CU232EP1	Elective Lab Course II: Systematic Analysis of Organic Compounds Botany and Zoology Major	2	2
<b>Part IV</b>	CU232NM1	Non Major Elective NME II: Cosmetics and Personal Grooming	2	2
	CU232SEI	Skill Enhancement Course SEC I: Dairy Chemistry	2	2
<b>Total</b>			<b>23</b>	<b>30</b>

### Co-curricular Courses

Part	Semester	Code	Title of the Course	Credit
Part V	I & II	UG232LC1	Life Skill Training I: Catechism	1
		UG232LM1	Life Skill Training I: Moral	
	I	UG231C01 – UG231C--	Skill Development Training (SDT) - Certificate Course	1
	II	CU232FP1	Field Project	1
	I & III	CU231V01- CU231V--/ CU233V01 – CU233V--	Specific Value-added Course	1+1
	II, IV & VI	-	MOOC	1+1+1
	III & IV	UG234LC1	Life Skill Training II: Catechism	1
		UG234LM1	Life Skill Training II: Moral	
	IV & VI	UG234V01- UG234V--/ UG236V01- UG236V--	Generic Value-added Course	1 +1
	I - IV	UG234ST1	Student Training Activity – Clubs & Committees / NSS	1
	IV	UG234CE1	Community Engagement Activity - RUN	1
	V	UG235HR1	Human Rights Education	1
	VI	UG236GS1	Gender Equity Studies	1
			<b>Total</b>	<b>15</b>

### Specific Value added Course

S. No.	Course code	Title of the course	Credits	Total hours
I	CU231V01	Articles in Every Day Life	1	30

### Examination Pattern

Each paper carries an internal component.

There is a passing minimum for external component.

A minimum of 40% in the external examination and an aggregate of 40% is required.

### a. Part I – Tamil, Part II – English, Part III - (Core Course/ Elective Course)

Ratio of Internal and External= 25:75

#### Continuous Internal Assessment (CIA)

#### Internal Components and Distribution of Marks

Components	Marks
Internal test (2) (40 marks)	10
Quiz (2) (20 marks)	5

Assignment: (Model Making, Exhibition, Role Play, Seminar, Group Discussion, Problem Solving, Class Test, Open Book Test etc. (Minimum three items per course should be included in the syllabus & teaching plan) (30 marks)	10
<b>Total</b>	<b>25</b>

### Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 4 x 1 (No choice)	4	Part A 10 x 1 (No choice)	10
Part B 3 x 4 (Internal choice)	12	Part B 5 x 6 (Internal choice)	30
Part C 3 x 8 (Internal choice)	24	Part C 5 x 12 (Internal choice)	60
<b>Total</b>	<b>40</b>	<b>Total</b>	<b>100</b>

#### Lab Course:

Ratio of Internal and External = 25:75

Total: 100 marks

#### Internal Components and Distribution of Marks

Internal Components	Marks
Performance of the Experiments	10
Regularity in attending practical and submission of records	5
Record	5
Model exam	5
<b>Total</b>	<b>25</b>

#### Question pattern

External Exam	Marks
Major Practical	75
Minor Practical / Spotters / Record	
<b>Total</b>	<b>75</b>

#### Core Project

Ratio of Internal and External = 25:75

Components	Marks
<b>Internal</b>	25
<b>External</b>	
Report	40
Viva voce	35

#### Part - IV

##### i. Non-major Elective, Foundation Course, Skill Enhancement Course, Value Education, Professional Competency Skill

Ratio of Internal and External = 25: 75



## Internal Components and Distribution of Marks

Components	Marks
Internal test (2)	10
Quiz (2)	5
Assignment: (Model Making, Exhibition, Role Play, Album, Group Activity (Mime, Skit, Song) (Minimum three items per course)	10
<b>Total</b>	<b>25</b>

## Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 2 x 2 (No Choice)	4	Part A 5 x 2 (No Choice)	10
Part B 3 x 4 (Open choice <b>Three out of Five</b> )	12	Part B 5 x 5 (Open choice any <b>Five out of Eight</b> )	25
Part C 1 x 9 (Open choice <b>One out of Three</b> )	9	Part C 5 x 8 (Open choice any <b>Five out of Eight</b> )	40
<b>Total</b>	<b>25</b>	<b>Total</b>	<b>75</b>

## ii. Environmental Studies

### Internal Components

Component	Marks
Project Report	15
Viva voce	10
<b>Total</b>	<b>25</b>

## Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 2 x 2 (No Choice)	4	Part A 5 x 2 (No Choice)	10
Part B 3 x 4 (Open choice <b>Three</b> out of <b>Five</b> )	12	Part B 5 x 5 (Open choice any <b>Five</b> out <b>of Eight</b> )	25
Part C 1 x 9 (Open choice <b>One</b> out of <b>Three</b> )	9	Part C 5 x 8 (Open choice any <b>Five</b> out <b>of Eight</b> )	40
<b>Total</b>	<b>25</b>	<b>Total</b>	<b>75</b>

## iii. Summer Internship/Industrial Training

Components	Marks
Industry Contribution	50
Report & Viva-voce	50

## Co-Curricular Courses:

### i. Life Skill Training: Catechism & Moral, Human Rights Education & Gender Equity Studies

#### Internal Components

Component	Marks
Project - Album on current issues	25
Group Song/ Mime/ Skit	25
<b>Total</b>	<b>50</b>

#### External Components

Component	Marks
Quiz	20
Written Test: Open choice – 5 out of 7 questions (5 x 6)	30
<b>Total</b>	<b>50</b>

### ii. Skill Development Training (SDT) - Certificate Course:

Components	Marks
Attendance & Participation	50
Skill Test	50

### iii. Field Project:

Components	Marks
Field Work	50
Report & Viva-voce	50

### iv. Specific Value-Added Courses & Generic Value-Added Courses:

Components	Marks
Internal	25
External	75

### v. Community Engagement Activity: Reaching the Unreached Neighbourhood (RUN)

Components	Marks
Attendance & Participation	50
Field Project	50

### vi. Student Training Activity: Clubs and Committees

Compulsory for all I & II year students (1 credit).

Component	Marks
Attendance	25
Participation	25
<b>Total</b>	<b>50</b>

## Outcome Based Education (OBE)

### (i) Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/Understanding	The learner explains ideas or concepts

3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

**(ii) Weightage of K – Levels in Question Paper**

**Number of questions for each cognitive level:**

Programme	Assessment	Lower Order Thinking									Higher order thinking			Total number of questions
		K1			K2			K3			K4, K5, K6			
	Part	A	B	C	A	B	C	A	B	C	A	B	C	
I UG	Internal	2	2		1	1	1	1	-	2	-	-	-	10
	External	5	2	1	3	2	2	2	1	2	-	-	-	20
II UG	Internal	1	-	1	1	2		1	-	1	1	1	1	10
	External	5	1	1	4	1	1	-	3	1	1	-	2	20
III UG	Internal	1	1	-	-	1	-	1	-	1	2	1	2	10

**Evaluation**

- The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade points.
- Evaluation of each course shall be done by Continuous Internal Assessment (CIA) by the course teacher as well as by an end semester examination and will be consolidated at the end of the semester.
- There shall be examinations at the end of each semester, for odd semesters in October/November; for even semesters in April/ May.
- A candidate who does not pass the examination in any course(s) shall be permitted to reappear in such failed course(s) in the subsequent examinations to be held in October/ November or April/May. However, candidates who have arrears in practical examination shall be permitted to reappear for their areas only along with regular practical examinations in the respective semester.
- Viva-voce: Each project group shall be required to appear for Viva -voce examination in defence of the project.
- The results of all the examinations will be published in the college website.

**Conferment of Bachelor’s Degree**

A candidate shall be eligible for the conferment of the Degree of Bachelor of Arts / Science / Commerce only if the minimum required credits for the programme thereof (140 + 18 credits) is earned.

**Grading System**

**For the Semester Examination:**

**Calculation of Grade Point Average for End Semester Examination:**

$$\text{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the course}}{\text{Sum of the credits of the courses (passed) in a semester}}$$

**For the entire programme:**

$$\text{Cumulative Grade Point Average (CGPA)} \frac{\sum_n \sum_i C_{ni} G_{ni}}{\sum_n \sum_i C_{ni}}$$

$$\text{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

Where

$C_i$  - Credits earned for course i in any semester

$G_i$  - Grade point obtained for course i in any semester

n - semester in which such courses were credited

**Final Result**

**Conversion of Marks to Grade Points and Letter Grade**

Range of Marks	Grade Points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
40-49	4.0-4.9	C	Satisfactory
00-39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

**Overall Performance**

CGPA	Grade	Classification of Final Result
9.5-10.0	O+	First Class – Exemplary*
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction*
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.0 and above but below 5.0	C	Third Class
0.0 and above but below 4.0	U	Re-appear

\*The candidates who have passed in the first appearance and within the prescribed semester are eligible for the same.

## SEMESTER – I

### CORE COURSE – I : GENERAL CHEMISTRY - I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU231CC1	5	-	-	-	5	5	75	25	75	100

**Prerequisites:** Higher secondary chemistry

#### Learning Objectives

1. To understand various atomic models and atomic structure
2. To realize the wave particle duality of matter
3. To learn periodic table, periodicity in properties and its application in explaining the chemical behaviour
4. To know the nature of chemical bonding, and
5. To understand the fundamental concepts of organic chemistry

#### Course Outcomes

On the successful completion of the course, student will be able to:		
1	remember the atomic structure, periodic properties, bonding, electronic configuration and properties of compounds.	<b>K1</b>
2	understand and classify the elements in the periodic table, types of bonds, reaction intermediates, electronic effects in organic compounds and types of reagents.	<b>K2</b>
3	apply the theories to calculate energy of spectral transition, electronegativity, percentage ionic character and bond order.	<b>K3</b>
4	analyse the relationship existing between electronic configuration, bonding, geometry of molecules, structure reactivity and electronic effects	<b>K4</b>
5	evaluate the trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.	<b>K5</b>

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate

Unit	Contents	No. of Hours
I	<b>Atomic structure and Periodic trends</b> History of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De-Broglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli'exclusion principle and Aufbau principle. Numerical problems involving the core concepts.	<b>15</b>

II	<p><b>Introduction to Quantum mechanics</b>  Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wavefunctions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of <math>\Psi</math> and <math>\Psi^2</math>.</p> <p><b>Modern Periodic Table</b>  <b>Cause of periodicity</b>; Features of the periodic table; classification of elements - Periodic trends for atomic size- atomic radii, ionic and covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales Mulliken and Paulings scales of electronegativity, applications of electronegativity.  Problems involving the core concepts</p>	15
III	<p><b>Structure and bonding – I</b>  <b>Ionic bond</b>  Ionic bond-definition; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies-applications of lattice energy, Ion polarisation– polarising power and polarizability; Fajans’ rules - effects of polarisation on properties of compounds; problems involving the core concepts.</p> <p><b>Covalent bond</b>  Shapes of orbitals, overlap of orbitals – <math>\sigma</math> and <math>\Pi</math> bonds; hybridization-types-<math>sp, sp^2, sp^3</math>-examples. VSEPR theory - shapes of molecules of the type <math>AB_2, AB_3, AB_4, AB_5, AB_6</math> and <math>AB_7</math>  Partial ionic character of covalent bond-dipole moment, percentage ionic character- numerical problems based on calculation of percentage ionic character.</p>	15
IV	<p><b>Structure and bonding – II</b>  VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – <math>CO_2, NO_2, CO_3^{2-}, NO_3^-</math> limitations of VBT; MO theory - bonding, antibonding and non bonding orbitals, bond order; MO diagrams of <math>H_2, C_2, O_2, O_2^+, O_2^-, N_2, NO, HF, CO</math>; magnetic characteristics, comparison of VB and MO theories.</p> <p>Co-ordinate bond: Definition, Formation of <math>BF_3, NH_3</math> molecules  Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors</p> <p>Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, inter and intramolecular- special properties of water, ice, viscosity of glycerol, melting and boiling points.</p>	15
V	<p><b>Basic concepts in Organic Chemistry and Electronic effects</b>  Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction</p>	15

	intermediates – carbanions, carbocations, carbenes, arynes and nitrynes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductive and electromeric effects. Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, steric inhibition to resonance Hyperconjugation - stability of alkenes, orienting effect of methyl group, dipole moment of aldehydes and nitromethane. Types of organic reactions- addition, substitution, elimination and rearrangements.	
<b>TOTAL</b>		<b>75</b>
Self study	Atomic models, Periodic table, Chemical bonding, Theories of bonding and Electronic effects	

### Textbooks

1. Madan, R.D. Sathya Prakash. 2003. Modern Inorganic Chemistry, 2<sup>nd</sup>ed.; S. Chand and Company, New Delhi.
2. Rao, C.N. R. 2000. University General Chemistry, Macmillan Publication: New Delhi.
3. Puri, B. R., L. R. Sharma. 2002. Principles of Physical Chemistry, 38<sup>th</sup>ed.; Vishal Publishing Company: Jalandhar.
4. Bruce, P. Y., K. J. R. Prasad. 2008. Essential Organic Chemistry, Pearson Education, New Delhi.
5. Dash, U.N., O.P. Dharmarha, P. L. Soni. 2016. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi.

### Reference Books

1. Maron, S. H., C.P. Prutton. 1972. Principles of Physical Chemistry, 4<sup>th</sup>ed., The Macmillan Company: Newyork.
2. Lee, J. D. 1991. Concise Inorganic Chemistry, 4<sup>th</sup> ed., ELBS William Heinemann, London.
3. Gurudeep Raj, 2001. Advanced Inorganic Chemistry, 26<sup>th</sup>ed., Goel Publishing House: Meerut.
4. Atkins, P.W., J. Paula. 2014. Physical Chemistry, 10<sup>th</sup> ed., Oxford University Press: New York.
5. Huheey, J. E. 1993. Inorganic Chemistry: Principles of Structure and Reactivity, 4<sup>th</sup> ed. Addison, Wesley Publishing Company: India.

### Web Resources

1. <https://onlinecourses.nptel.ac.in>

2. [http://www.mikeblaber.org/oldwine/chm1045/notes\\_m.htm](http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm)
3. [http://www.ias.ac.in/initiat/sci\\_ed/resources/chemistry/Inorganic.html](http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html)
4. <https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding>
5. <https://www.chemtube3d.com/>

**MAPPING WITH PROGRAMME OUTCOMES  
AND PROGRAMME SPECIFIC OUTCOMES**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
<b>CO1</b>	3	2	3	3	2	2	3	3	2	2	2	2	3	3	2
<b>CO2</b>	3	2	3	3	2	2	3	3	3	2	2	2	3	3	2
<b>CO3</b>	3	2	2	3	2	2	3	3	3	3	2	3	3	2	2
<b>CO4</b>	3	2	2	3	2	2	3	3	3	3	2	2	3	2	2
<b>CO5</b>	3	2	2	3	2	2	3	3	3	3	2	2	3	2	2
<b>TOTAL</b>	15	10	12	15	10	10	15	15	14	13	10	11	15	12	10
<b>AVERAGE</b>	3	2	2.4	3	2	2	3	3	2.8	2.6	2	2.2	3	2.4	2

**3 – Strong, 2- Medium, 1- Low**



## SEMESTER – I

### CORE PRACTICAL I : QUANTITATIVE INORGANIC ESTIMATION (TITRIMETRY) AND INORGANIC PREPARATIONS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU231CP1	-	-	3	-	3	3	45	25	75	100

**Prerequisites:** Higher secondary chemistry

#### Learning Objectives

1. To understand the concepts of quantitative analysis
2. To recognize the indicators, acid and bases used in volumetric analysis
3. To gain knowledge on laboratory safety and handling glasswares
4. To utilize mathematical skills for calculation
5. To get knowledge on the preparation of inorganic compounds

#### Course Outcomes

On the successful completion of the course, student will be able to:		
1	explain the basic principles involved in titrimetric analysis and inorganic preparations.	<b>K1</b>
2	compare the methodologies of different titrimetric analysis.	<b>K2</b>
3	calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.	<b>K3</b>
4	assess the yield of different inorganic preparations and identify the end point of various titrations	<b>K4</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

S.No	Contents	No. of Hours
I.	<p><b>Chemical Laboratory Safety in Academic Institutions</b> Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.</p> <p><b>Common Apparatus Used in Quantitative Estimation (Volumetric)</b> Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.</p>	<b>15</b>

	<p><b>Principle of Quantitative Estimation (Volumetric)</b>  Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.</p>	
2.	<p><b>Quantitative Estimation(Volumetric)</b>  Preparation of standard solution, dilution from stock solution  <b>Permanganometry</b>  Estimation of oxalic acid using standard ferrous ammonium sulphate  <b>Dichrometry</b>  Estimation of Ferrous Ammonium Sulphate using standard dichromate (external indicator)  Estimation of Ferrous Ammonium Sulphate using standard dichromate (internal indicator)  <b>Iodometry</b>  Estimation of copper in copper sulphate using standard dichromate  <b>Argentometry</b>  Estimation of chloride in barium chloride using standard sodium chloride/</p>	15
3.	<p><b>Complexometry</b>  Estimation of hardness of water using EDTA  Estimation of Zinc using EDTA  Estimation of Magnesium using EDTA  Estimation of Lead using EDTA  <b>Preparation of Inorganic compounds</b>  Potash alum  Tetra ammine copper (II) sulphate  Prussian Blue  Mohr's Salt</p>	15
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.	
	<b>TOTAL</b>	<b>45</b>
Self study	Equivalent weight and Calculation of normality	

### Textbooks

- 1 Venkateswaran, V., R. Veeraswamy, A.R. Kulandivelu. 1997. Basic Principles of Practical Chemistry, 2<sup>nd</sup> ed., Sultan Chand & Sons, New Delhi.
- 2 Nad, A. K., B. Mahapatra, A. Ghoshal. An advanced course in Practical
- 3 Thomas, A.O. 1999. Practical Chemistry for B.Sc Main students. Scientific book centre, Cannanore.
- 4 Vogel, A.I. 1990. A Text Book for Qualitative Inorganic Analysis. The English Language Book Society and Longmans.

### Reference Books

1. Mendham, J., R.C. Denney, J.D. Barnes, M. Thomas, B. Sivasankar. 2000. Vogel's Textbook of Quantitative Chemical Analysis, 6<sup>th</sup> ed.; Pearson Education Ltd, New Delhi.

### Web Resources

1. <http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis>
2. <https://chemdictionary.org/titration-indicator/>

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
<b>CO1</b>	3	2	3	3	2	2	3	3	2	2	2	2	3	3	2
<b>CO2</b>	3	2	3	3	2	2	3	3	3	2	2	2	3	3	2
<b>CO3</b>	3	2	2	3	2	2	3	3	3	3	2	3	3	2	2
<b>CO4</b>	3	2	2	3	2	2	3	3	3	3	2	2	3	2	2
<b>TOTAL</b>	12	8	10	12	8	8	12	12	11	10	8	9	12	10	8
<b>AVERAGE</b>	3	2	2.5	3	2	2	3	3	2.8	2.5	2	2.25	3	2.5	2

**3 – Strong, 2- Medium, 1- Low**

## SEMESTER – I

### ELECTIVE COURSE I: BOTANY AND ZOOLOGY MAJOR

#### CHEMISTRY FOR BIOLOGICAL SCIENCES - I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU231EC1	4	-	-	-	3	4	60	25	75	100

**Prerequisites:** Higher secondary chemistry

#### Learning Objectives

1. To gain knowledge on the significance and shapes of atomic orbitals
2. To understand the basics of biophysical analysis and industrial chemistry
3. To recognize the role of drugs, separation and purification techniques.

#### Course Outcomes

On the successful completion of the course, student will be able to:		
CO1	remember the atomic structure, the preparation and uses of various compounds	<b>K1</b>
CO2	understand the efficiencies and uses of various drugs, fertilizers and fuels.	<b>K2</b>
CO3	explain and apply various theories behind osmosis, catalysis and chromatography	<b>K3</b>
CO4	differentiate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.	<b>K4</b>
CO5	analyse various methods to separate chemical compounds	<b>K4</b>

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze

Unit	Contents	No. of Hours
I	<p><b>Atomic Structure</b></p> <p>Dual nature of electron - de-Broglie equation - Davisson and Germer experiment. Heisenberg's uncertainty principle and its significance. Compton effect - Schrodinger's wave equation and its significance - eigen values and eigen functions - quantum numbers and their significance.</p> <p>Atomic orbitals - significance - shapes - difference between orbit and orbital. Rules for filling up of orbitals - Pauli's exclusion principle - Aufbau principle - Hund's rule. Electronic configuration of elements up to 20.</p>	12
II	<p><b>Industrial Chemistry</b></p> <p>Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details)</p>	12

	not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.	
III	<b>Biophysical Analysis and Catalysis</b> Osmosis - osmotic pressure - isotonic solutions. Determination of molar mass by osmotic pressure measurement. Reverse osmosis. Adsorption - types - factors influencing adsorption and applications. Catalysis - types - theories - intermediate compound formation theory and adsorption theory.	12
IV	<b>Drugs and Speciality Chemicals</b> Definition and uses - Antibiotics- penicillin, chloramphenicol and streptomycin. Anaesthetics - chloroform and ether. Antipyretics - aspirin, paracetamol and ibuprofen. Artificial Sweeteners - saccharin, aspartame and cyclamate .Organic Halogen compounds – freon and teflon.	12
V	<b>Analytical Chemistry</b> Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.	12
<b>TOTAL</b>		<b>60</b>
<b>Self Study</b>	Electronic configuration of elements, Properties and uses of silicones, Types of Catalysis, Artificial sweeteners and Applications of chromatography.	

### Textbooks

1. Veeraiyan, V. 2009. Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition.
2. Vaithyanathan, S. 2006. Text book of Ancillary Chemistry; Priya Publications, Karur.
3. Arun Bahl, B.S.Bahl. 2012. Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition.
4. Soni, P.L., H.M. Chawla. 2007. Text Book of Inorganic Chemistry, Sultan Chand & sons, New Delhi, twenty ninth edition.

### Reference Books

1. Soni, P. L., Mohan Katyal. 2007. Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition.
2. Sharma, B.K. 2014. Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition.
3. Jayashree Gosh, Fundamental Concepts of Applied Chemistry;

## Web Resources

1. <https://alison.com/course/chemistry-atomic-structure>
2. <https://www.udemy.com/course/atomic-structure/>
3. <https://www.classcentral.com/course/swayam-industrial-inorganic-chemistry-12912>
4. <https://nptel.ac.in/courses/104105103>
5. [https://www.udemy.com/topic/Analytical-Chemistry/?utm\\_source=adwords&utm\\_medium=udemyads&utm\\_campaign=DSA\\_](https://www.udemy.com/topic/Analytical-Chemistry/?utm_source=adwords&utm_medium=udemyads&utm_campaign=DSA_)

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
<b>CO1</b>	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2
<b>CO2</b>	3	2	2	3	3	2	2	3	2	2	2	2	3	2	2
<b>CO3</b>	3	2	3	3	3	2	2	3	2	2	2	2	2	2	3
<b>CO4</b>	3	2	3	2	2	2	2	3	2	2	2	2	2	3	2
<b>CO5</b>	3	3	3	3	3	2	2	3	2	2	2	2	2	2	2
<b>TOTAL</b>	15	11	13	13	13	10	10	15	10	10	10	10	11	11	11
<b>AVERAGE</b>	3	2.2	2.6	2.6	2.6	2	2	3	2	2	2	2	2.2	2.2	2.2

**3 – Strong, 2- Medium, 1- Low**

## SEMESTER – I

### ELECTIVE PRACTICAL I: VOLUMETRIC ANALYSIS (BOTANY AND ZOOLOGY MAJOR)

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU231EP1	-	-	2		2	2	30	25	75	100

#### Prerequisites:

Higher secondary chemistry

#### Learning Objectives

1. To understand the basics of preparation of solutions.
2. To understand the principles and practical experience of volumetric analysis.

#### Course Outcomes

On the successful completion of the course, student will be able to:		
CO1	understand the principles of titrimetric methods.	<b>K1</b>
CO2	gain knowledge on the usage of standard flask, pipette and burette.	<b>K2</b>
CO3	design, carry out, record and interpret the results of various titrations and apply their skill in the estimation of various compounds.	<b>K3</b>
CO4	analyze the suitable indicators for various titrations	<b>K4</b>

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze

Contents	No. of Hours
<p style="text-align: center;"><b>VOLUMETRIC ANALYSIS</b></p> <ol style="list-style-type: none"> <li>1. Estimation of sodium hydroxide using standard sodium carbonate.</li> <li>2. Estimation of sulphuric acid using standard oxalic acid.</li> <li>3. Estimation of ferrous sulphate using standard Mohr's salt.</li> <li>4. Estimation of oxalic acid using standard ferrous sulphate.</li> <li>5. Estimation of zinc using EDTA.</li> <li>6. Estimation of magnesium using EDTA.</li> <li>7. Estimation of ferrous ion using potassium dichromate.</li> </ol>	<b>30</b>
<b>TOTAL</b>	<b>30</b>
Self Study	Demonstration

**Text books**

1. Venkateswaran, V., R. Veeraswamy, A.R. Kulandivelu. 1997. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand & Sons: New Delhi.
2. Nad, A. K., B. Mahapatra, A. Ghoshal, An advanced course in Practical
3. Thomas, A.O. 1999. Practical Chemistry for B.Sc Main students. Scientific book centre, Cannanore.
4. Vogel, A.I. (1990). A Text Book for Qualitative Inorganic Analysis. The English Language Book Society and Longmans.

**Reference Books**

1. V. Venkateswaran, R. Veerasamy, A.R. Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

**Web Resources**

1. <http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis>
2. <https://chemdictionary.org/titration-indicator/>

**MAPPING WITH PROGRAMME OUTCOMES  
AND PROGRAMME SPECIFIC OUTCOMES**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
<b>CO1</b>	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2
<b>CO2</b>	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2
<b>CO3</b>	3	2	3	3	3	2	2	3	2	2	2	2	2	2	2
<b>CO4</b>	3	2	3	2	2	2	2	3	2	2	2	2	2	2	2
<b>CO5</b>	3	3	3	3	3	2	2	3	2	2	2	2	2	2	3
<b>TOTAL</b>	15	12	14	13	13	10	10	15	10	10	10	11	10	10	11
<b>AVERAGE</b>	3	2.4	2.8	2.6	2.6	2	2	3	2	2	2	2.2	2	2	2.2

**3 – Strong, 2- Medium, 1- Low**



## SEMESTER – I

### NON MAJOR ELECTIVE NME I : FOOD CHEMISTRY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU231NM1	2	-	-	-	2	2	30	25	75	100

**Pre-requisite:**

Students should have basic knowledge on food chemistry.

**Learning Objectives:**

1. To know about adulterations used in food and their impact on health.
2. To learn the different types of additives used in food.
3. To gain knowledge on diseases caused by beverages

#### Course Outcomes

On the successful completion of the course, student will be able to:		
1	remember and recall the different types of adulterants in food, edible oils used in foods and beverages.	<b>K1</b>
2	understand the effect of chemicals in common food and their adverse impact on health.	<b>K2</b>
3	apply various methods to detect various adulterants in food and to determine the values of oils and fats.	<b>K3</b>
4	analyze the effects of contaminants and additives in food.	<b>K4</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze;

Unit	Contents	No. of Hours
I	<b>Food Adulteration</b> Sources of food, types, advantages and disadvantages. Food adulteration - contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals -Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques.	6
II	<b>Food Poison</b> Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) -Chemical poisons - First aid for poison consumed victims.	6
III	<b>Food Additives</b> Food additives - artificial sweeteners-Saccharin-Cyclamate and Aspartate - Food flavours - esters, aldehydes and heterocyclic compounds – Food colours – Emulsifying agents – preservatives - leavening agents. Baking powder – yeast – tastemakers – MSG - vinegar.	6
IV	<b>Beverages</b> Beverages-soft drinks-soda-fruit juices-alcoholic beverages-examples. Carbonation-addiction to alcohol– diseases of liver and social problems.	6
V	<b>Edible Oils</b> Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats and oils-examples - iodine value - determination of iodine value, acid value, RM value,	6

	saponification values and their significance- Role of MUFA and PUFA in preventing heart diseases.	
<b>Self study</b>	Contamination of wheat, Saccharin, Food colours, Sources of oils	

### Textbooks

1. Chopra, H.K., Panesar, P.S. 2010. Food chemistry, Narosa publishing house.
2. Jayashree Ghosh. 2006. Fundamental Concepts of Applied Chemistry(Second edition), Chand & Co. Publishers.
3. Belitz, H.D., Grosch, W., Schieberle, P. 2009. Food Chemistry (Fourth revised and extended edition), Springer.
4. Subbulakshmi, G. Shobha. A. U, Padmini .S. G. 2021. Food processing and preservation (Second edition). New age international publishers.

### Reference Books

1. Belitz, H.D., Werner, G. 2009. Food Chemistry (Fourth Edition) .Springer Science & Business Media, 2009.
2. Swaminathan, M, 1979. Food Science and Experimental Foods, Ganesh and Company.
3. Hasenhuettl, G. L., Hartel, R. W. 2008. Food Emulsifiers and their applications (Second Edition) Springer New York.
4. Belitz, H.D., Grosch, W., Schieberle, P. 2009. Food Chemistry (Fourth revised and extended edition), Springer.
5. John, M., D., John W. F., Jefferey, W. Principles of food chemistry (Fourth Edition). Springer.

### Web Resources

1. <https://authors.library.caltech.edu.in>
2. <http://ecoursesonline.iasri.res.in/course/view.php?id=89>
3. [https://onlinecourses.swayam2.ac.in/cec20\\_ag10/preview](https://onlinecourses.swayam2.ac.in/cec20_ag10/preview)
4. <https://www.igmpiindia.org/FoodCampaign/Adword.php?gclid=Cj0>
5. <https://www.classcentral.com/course/swayam-food-chemistry-14061>

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
<b>CO1</b>	3	2	3	2	2	3	2	3	2	2	3	2	2	2	2
<b>CO2</b>	3	2	3	3	3	2	2	3	2	2	3	2	2	3	2
<b>CO3</b>	3	2	3	3	3	2	2	3	2	2	2	3	2	2	2
<b>CO4</b>	3	2	3	2	2	2	2	3	2	2	3	2	2	2	2
<b>CO5</b>	3	2	3	2	3	2	2	3	2	2	2	2	2	3	2
<b>TOTAL</b>	15	10	15	12	13	11	10	15	10	10	13	11	10	11	10
<b>AVERAGE</b>	3	2	3	2.4	2.6	2.2	2	3	2	2	2.6	2.2	2	2.2	2

3 – Strong, 2- Medium, 1- Low

**SEMESTER I**  
**FOUNDATION COURSE: BASICS OF CHEMISTRY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU231FC1	2	-	-	-	2	2	30	25	75	100

**Pre-requisite:**

Higher secondary Chemistry

**Learning Objectives:**

1. To understand the concepts of periodic classification, chemical bonding, nomenclature of organic compound, isomerism and state of matter.
2. To acquire knowledge on various spectroscopic techniques.

**Course Outcomes**

On the successful completion of the course, student will be able to:		
CO 1	remember the basic concepts of periodic classification, chemical bonding, nomenclature of organic compound, isomerism and state of matter.	<b>K1</b>
CO 2	understand the periodic properties, types of bonding, hybridization, stereo isomerism, properties of matter and spectroscopy.	<b>K2</b>
CO 3	apply the concepts of valence bond theory, hybridization, isomerism IUPAC nomenclature and spectroscopy to chemical compounds.	<b>K3</b>
CO 4	analyze the periodic properties of elements, magnetic properties, characteristic of solids and types of spectroscopic techniques.	<b>K4</b>
CO 5	evaluate quantum numbers and their significance and percentage of ionic character of compounds.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

Units	Contents	No. of Hours
<b>I</b>	<b>Structure of atom and periodic classification of Elements and properties</b> Atomic structure - Fundamental particles - Atomic mass - Atomic number - Isotopes - Isobars - Isotones - Orbitals - Quantum number and their significance. Shapes of s,p and d orbitals - Rules governing electronic configuration in various atomic orbitals. Periodic table - periodic laws (Mendeleev and Mosley) - Classification of elements into s, p, d and f-blocks. Metals - Non-metals - Periodic properties - Concept, Variation and factors affecting various periodic properties - Inert pair effect.	<b>6</b>
<b>II</b>	<b>Chemical Bonding</b> Definition - Types of chemical bond - Ionic bond - Ion polarization - Dipole moment and Percentage of ionic character - Covalent bond - Definition - Postulates of Valence bond theory and Concept of hybridization ( $sp$ , $sp^2$ , $sp^3$ , $sp^3d$ , $sp^3d^2$ , $dsp^2$ , $d^2sp^3$ ) - Magnetic properties - Paramagnetic - Diamagnetic - Ferromagnetic. Co-ordinate covalent bond - Definition - Examples - Co-ordination compounds (basic concepts only).	<b>6</b>
<b>III</b>	<b>Nomenclature and Isomerism in Organic compounds</b> Carbon compounds - Uniqueness of carbons - Classification of hydrocarbons - IUPAC Nomenclature of Organic compounds Isomerism: Structural and Stereoisomerism Structural Isomerism: Chain isomerism,	<b>6</b>

	Functional isomerism, Positional isomerism and Meta isomerism. Stereoisomerism: Geometrical and Optical isomerism - Chiral molecule - Enantiomers - Diastereomers - Meso compounds - Racemic mixture.	
<b>IV</b>	<b>States of Matter</b> Gaseous state: Kinetic theory of gases - Ideal and Non-ideal gases - Ideal gas equation - Deviation of ideal gas from ideal behaviour - vander Waal's equation and Liquification of gases. Liquids: Intermolecular forces, Vapour pressure and Boiling point of liquid - Surface tension - Viscosity - Factors affecting surface tension and viscosity. Solids: Definition - Characteristics of solids- Amorphous and Crystalline solids - Space lattice and unit cells - Close packed structure of solids- Radius ratio rule.	<b>6</b>
<b>V</b>	<b>Introduction to Spectroscopy</b> Electromagnetic radiation - General characteristics of Wave - Wavelength - Frequency - Amplitude - Wave number - Electromagnetic spectrum- Absorption and Emission spectrum - Quantization of Energy level - Selection rule - Intensity of the Spectral lines - Width of Spectral lines. Types of spectroscopy: Microwave spectroscopy, Infrared spectroscopy, UV-Visible spectroscopy, Nuclear Magnetic Resonance spectroscopy, Electron spin resonance spectroscopy.	<b>6</b>
	<b>Total</b>	<b>30</b>
<b>Self-study</b>	Periodic table - periodic laws (Mendeleev and Mosley) ,Types of chemical bonds, Classification of hydrocarbons ,Characteristics of solids,Electromagnetic radiation and general characteristics of Wave	

#### **Text Books**

1. Puri, B.R., Sharma, L.R., Kalia, K.C., 2014, Principles of Inorganic chemistry (Thirty First Edition). Milestone Publishers and Distributors, New Delhi.
2. Banerjee, S.P., 2017, Advanced Inorganic Chemistry (Second Edition). Arunabha Sen, Books and Allied (P) Ltd., Kolkata.
3. Tewari, K.S., Mehrothra, S.N., Vishnoi, N.K., 1998, Text book of Organic Chemistry (Second Edition). Vikas publishing House, New Delhi.
4. Puri, B.R., Sharma, L.R., Pathania, M.S., 2019, Principles of Physical Chemistry (Fourty Seventh Edition). Vishal Publishers, India.
5. Sharma, Y.R., 2013, Elementary Organic Spectroscopy (Fifth Edition). S. Chand Publishing, New Delhi.

#### **Reference Books**

1. Madan, R.D., 2014, Modern Inorganic Chemistry (Thirteenth Edition). Sultan Chand Publishers, India.
2. Jain, M.K., Sharma, S.C., 2015, Modern Organic Chemistry. Vishal Publishers, India.
3. Soni, P.L., 2000, Text book of Organic Chemistry (Twentieth Edition). Sultan Chand Publishers, India.
4. Kundu, N., Jain S.K., 2000, A Text Book of Physical Chemistry. S Chand & Company Ltd., New Delhi.
5. Kalsi, P.S., 2004, Spectroscopy of Organic Compounds (Sixth Edition). New Age International Ltd., India.
6. Kaur, H., 2006, Spectroscopy (Third Edition). Pragati Prakasan Publications, Meerut.
7. BanWell, C.N., Mccash, E.M., 1997, Fundamentals of Molecular Spectroscopy. Tata Mc Grow Hill, New Delhi.

### Web Resources

1. <https://www.udemy.com/course/chemistry-periodic-classification-of-elements/>
2. <https://alison.com/topic/learn/128224/chemical-bonding-learning-outcomes>
3. <http://www.adichemistry.com/organic/basics/iupac1/organic-iupac-nomenclature.html>
4. <https://byjus.com/chemistry/matter-solid-liquid-gas/>
5. [https://onlinecourses.nptel.ac.in/noc23\\_cy35/preview](https://onlinecourses.nptel.ac.in/noc23_cy35/preview)

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
<b>CO1</b>	3	2	2	2	2	2	3	3	2	2	2	2	2	2	2
<b>CO2</b>	3	2	2	2	2	2	3	3	2	2	2	2	3	2	2
<b>CO3</b>	3	2	2	2	2	2	3	3	3	2	2	2	3	2	2
<b>CO4</b>	3	2	2	2	2	2	3	3	3	2	2	2	3	2	2
<b>CO5</b>	3	2	2	2	2	2	3	3	3	2	2	2	3	2	2
<b>TOTAL</b>	15	10	10	10	10	10	15	15	13	10	10	10	14	10	10
<b>AVERAGE</b>	3	2	2	2	2	2	3	3	2.6	2	2	2	2.8	2	2

3 – Strong, 2- Medium, 1- Low

## SEMESTER I

### SPECIFIC VALUE ADDED COURSE – ARTICLES IN EVERY DAY LIFE

Course Code	Credit	Total Hours	Total Marks
CU231V01	1	30	100

**Pre-requisite:** Knowledge about the usage of chemicals in daily use.

#### Learning Objectives

1. To develop skill in preparing chemicals of every day use.
2. To know the uses and side effects of various chemicals.

#### Course Outcomes

On the successful completion of the course, student will be able to:		
CO 1	know about oils, fats and soaps	<b>K1</b>
CO 2	understand the methods to prepare some articles in daily use	<b>K2</b>
CO 3	apply the prepared things in daily life	<b>K3</b>
CO 4	remember the hazards of chemicals	<b>K2</b>
CO 5	analyze and use the safety compounds for their use	<b>K4</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

Unit	Contents	No. of Hours
<b>I</b>	Oils – difference between oils and fats –refining of oil–manufacture of soaps – toilet and transparent soaps -washing and shaving soaps, liquid soap- methods of preparation, cleaning action of soaps. – Detergents – synthetic detergents –classification and manufacture of anionic, cationic and non-ionic detergents and shampoo-Eco-friendly detergents.	<b>6</b>
<b>II</b>	Chemistry of face creams, cold cream, vanishing creams, toilet powders, hand lotion and creams, nail bleach, nail lacquer, nail lacquer removers, lipstick, eye-makeup, eye lid, hair oils, hair creams, hair dyes, hair removers, hazards of cosmetics.	<b>6</b>
<b>III</b>	Perfumes-definition- classification as natural and synthetic-composition or ingredients. Fixatives: Name of the oil, source, components.	<b>6</b>
<b>IV</b>	Tooth paste, tooth powder, boot polish, gum paste, sealing wax, phenyle, moth balls, liquid blues, chalk crayons, inks, agarpattis and camphor tablets	<b>6</b>
<b>V</b>	Preparation, properties and uses of washing soda, baking powder ,vinegar , bleaching powder, shampoo, washing powder and sugar.	<b>6</b>

#### Text Books:

1. Text book of Allied Chemistry by Dr. T. Syed Ismail, Aashiq Publications, 2011.
2. Applied Chemistry by D.M. Yusuff, Nisa Publications, 2010.

## SEMESTER II

### CORE COURSE II: GENERAL CHEMISTRY - II

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU232CC1	5	-	-	-	5	5	75	25	75	100

**Pre-requisite :** General Chemistry – I

#### Learning Objectives

1. To understand the chemistry of acids, bases and ionic equilibrium
2. To know the chemistry of hydrocarbons, applications of acids and bases

#### Course Outcomes

<b>On the successful completion of the course, students will be able to:</b>		
1.	explain the concept of acids, bases and ionic equilibria; periodic properties of s and p-block elements, preparation and properties of aliphatic and aromatic hydrocarbons	<b>K1</b>
2.	discuss the periodic properties of s and p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids	<b>K2</b>
3.	classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons	<b>K3</b>
4.	explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements	<b>K3</b>
5.	assess the application of acids, indicators, buffers, compounds of s and p- block elements and hydrocarbons	<b>K4</b>

**K1** - Remember; **K2** - Understand; **K3** – Apply; **K4**-Analyze

Units	Contents	No. of Hours
<b>I</b>	<p><b>Acids, bases and Ionic equilibria</b>            Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators; Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation; Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids - hydrolysis constant - degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product - determination and applications.</p>	<b>15</b>

<b>II</b>	<p><b>Chemistry of s and p - Block Elements</b></p> <p>Hydrogen: Position of hydrogen in the periodic table. General characteristics of alkali metals and alkaline earth metals-Electronic configuration, oxidation states, ionisation energy, reducing property, flame colouration, uses of alkali metals. Comparative study of oxides and hydroxides of alkali metals. Diagonal relationship of Li with Mg. Preparation, properties and uses of sodium cyanide, sodamide and potassium cyanide. Extraction of Be and its uses. General characteristics of p-Block Elements (Group 13 &amp; 14)-Electronic configuration, oxidation states and metallic character, preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses.</p>	<b>15</b>
<b>III</b>	<p><b>Chemistry of P Block Elements (Group 15-18)</b></p> <p>General characteristics of elements of Group 15; chemistry of H<sub>2</sub>N-NH<sub>2</sub>, NH<sub>2</sub>OH and HNO<sub>3</sub>. Chemistry of PH<sub>3</sub>, PCl<sub>3</sub>, PCl<sub>5</sub>, POCl<sub>3</sub>, P<sub>2</sub>O<sub>5</sub> and oxy acids of phosphorous (H<sub>3</sub>PO<sub>3</sub> and H<sub>3</sub>PO<sub>4</sub>). General properties of elements of group 16 - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens: General characteristics of halogen with reference to electronegativity, electron affinity and oxidation states. Peculiarities of fluorine. Inter-halogen compounds (ICl, ClF<sub>3</sub>, BrF<sub>5</sub> and IF<sub>7</sub>), pseudo halogens. Noble gases: Position in the periodic table-uses of noble gases.</p>	<b>15</b>
<b>IV</b>	<p><b>Hydrocarbon Chemistry-I</b></p> <p>Petroproducts: Fractional distillation of petroleum; cracking, Alkenes-Nomenclature, general methods of preparation – Mechanism of β- elimination reactions – E<sub>1</sub> and E<sub>2</sub> mechanism - orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, epoxidation, ozonolysis; polymerization. Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanization , polychloroprene. Alkynes Nomenclature; general methods of preparation (any two) and reactions; acidic nature of terminal alkynes and acetylene. Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations.</p>	<b>15</b>
<b>V</b>	<p><b>Hydrocarbon Chemistry - II</b></p> <p>Benzene: structure of benzene, stability of benzene ring, aromaticity, Huckel's (4n+2) rule. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity. Polynuclear Aromatic hydrocarbons: Naphthalene –Haworth synthesis; reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation, alkylation, and oxidation – uses. Anthracene – synthesis by Haworth synthesis; reactions - Diels-Alder reaction -uses.</p>	<b>15</b>

<b>Self-study</b>	General characteristics of s and p block elements and hydrocarbons
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**Textbooks**

1. Madan, R.D, Sathya Prakash, 2003, Modern Inorganic Chemistry, (second edition), S.Chand and Company, New Delhi.
2. Soni, P.L, 2000, Text book of Inorganic Chemistry.(Twentieth edition), Sultan Chand Publishers.



- Puri, Sharma, Kalia, 2021, Principles of Inorganic Chemistry, (Thirty third edition), Vishal Publishers.

### Reference Books

- Bruce, P. Y., K. J. R. Prasad, 2008, Essential Organic Chemistry, Pearson Education, New Delhi.
- Arun Bahl and Bahl. B.S , 2016, A Text Book of Organic Chemistry, (Twenty second edition), S. Chand & Company Ltd.
- Gurudeep Raj, 2001, Advanced Inorganic Chemistry, (Twenty Second), Goel Publishing House: Meerut.
- I. L. Finar, 2004, Organic Chemistry Vol-1& 2, (Sixth Edition), Pearson Education Asia.
- N. Tewari, 2011, Advanced Organic Reaction Mechanism, (Third Edition), Books & Allied (P) Ltd.

### Web Resources

- [https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/smlblack/chem1010/lecture\\_notes/4B.html](https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/smlblack/chem1010/lecture_notes/4B.html)
- [http://nptel.ac.in/courses/104101090/Classification of elements and periodic properties](http://nptel.ac.in/courses/104101090/Classification_of_elements_and_periodic_properties) <http://nptel.ac.in/courses/104101090/>
- <http://www.auburn.edu/~deruija/pdareson.pdf> <https://swayam.gov.in/course/64> - atomic-structure-and-chemical-bonding MOOC components
- <https://en.m.wikipedia.org>
- <https://www.sciencedirect.com>

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
<b>CO1</b>	3	1	2	3	3	2	2	3	3	2	2	2	3	3	3
<b>CO2</b>	3	3	1	2	3	2	3	3	3	2	2	2	3	3	3
<b>CO3</b>	3	2	2	2	3	2	3	3	3	3	3	1	2	2	3
<b>CO4</b>	3	2	2	2	3	2	3	3	3	3	3	2	3	2	3
<b>CO5</b>	3	2	3	3	1	2	3	3	3	3	3	3	3	3	3
<b>TOTAL</b>	15	10	10	10	13	10	14	15	15	13	13	10	14	13	15
<b>AVERAGE</b>	3	2	2	2	2.6	2	2.8	3	3	2.6	2.6	2	2.8	2.6	3

**3 – Strong, 2- Medium, 1- Low**

## SEMESTER – II

### CORE LAB COURSE II: ORGANIC ESTIMATION AND PREPARATION OF ORGANIC COMPOUNDS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU232CP1			3		3	3	45	25	75	100

#### Pre-requisite :

General Chemistry II

#### Learning Objectives:

1. To develop skill in estimating organic compounds
2. To prepare organic compounds

#### Course Outcomes

On the successful completion of the course, student will be able to:		
1.	explain the basic principles involved in organic estimation	<b>K1</b>
2.	know the methods of preparing organic compounds.	<b>K2</b>
3.	assess the yield of different organic preparations	<b>K3</b>
4.	compare the methodologies in preparing various compounds	<b>K4</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4**-Analyse

S.No	Contents
I	<b>Organic estimation</b> 1. Estimation of Phenol 2. Estimation of Aniline 3. Estimation of Ethyl methyl ketone – course work
II	<b>Preparation of Organic Compounds</b> i. Beta naphthyl benzoate from beta naphthol ii. p-bromo acetanilide from acetanilide iii. Benzoic acid from benzaldehyde iv. Benzoic acid from methyl benzoate v. Salicylic acid from methyl salicylate vi. Benzoic acid from benzamide

#### Text books

1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R, 2012, *Basic Principles of Practical Chemistry*, (Second edition), Sultan Chand: New Delhi.
2. Manna, A.K, 2018, *Practical Organic Chemistry*, Books and Allied: India.

## Reference Books

1. Thomas, A.O. 1999. Practical Chemistry for B.Sc Main students. Scientific book centre, Cannanore
2. Gurtu, J. N; Kapoor, R, 1987, *Advanced Experimental Chemistry (Organic)*, Sultan Chand: New Delhi.
3. Furniss, B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R, 1987, *Vogel's Textbook of Practical Organic Chemistry* (Fifth edition), Pearson: India,

## Web Resources

1. <https://authors.library.caltech.edu.in>
2. <https://www.vlab.co.in/broad-area-chemical-sciences>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
<b>CO1</b>	3	2	3	3	2	2	3	3	2	2	2	2	3	3	2
<b>CO2</b>	3	2	3	3	2	2	3	3	3	2	2	2	3	3	2
<b>CO3</b>	3	2	2	3	2	2	3	3	3	3	2	3	3	2	2
<b>CO4</b>	3	2	2	3	2	2	3	3	3	3	2	2	3	2	2
<b>TOTAL</b>	12	8	10	12	8	8	12	12	11	10	8	9	12	10	8
<b>AVERAGE</b>	3	2	2.5	3	2	2	3	3	2.8	2.5	2	2.25	3	2.5	2

**3 – Strong, 2- Medium, 1- Low**

**SEMESTER – II**  
**ELECTIVE COURSE II:**  
**CHEMISTRY FOR BIOLOGICAL SCIENCES – II**  
**BOTANY AND ZOOLOGY MAJOR**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU232EC1	4	-	-	-	3	4	60	25	75	100

**Prerequisites:**

Chemistry for Biological Sciences – I

**Learning Objectives**

1. To know about amino acids, lipids, essential elements of biosystem and fundamentals of photochemistry.
2. To understand the characteristics and structure of nucleic acids and vitamins.

**Course Outcomes**

On the successful completion of the course, student will be able to:		
CO1	remember the importance of amino acids and learn the basic concepts of Ayurveda	<b>K1</b>
CO2	understand the importance of nucleic acids and vitamins	<b>K2</b>
CO3	know the biological functions of lipids, oils and fats	<b>K1</b>
CO4	understand the function and deficiency of metals in human system	<b>K2</b>
CO5	outline the various type of photochemical process.	<b>K3</b>

K1 - Remember; K2 - Understand; K3 - Apply

Unit	Contents	No. of Hours
I	<b>Amino Acids and Essential elements of biosystem</b> Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification – structure - Colour reactions – Biological functions. Basic concepts of Ayurveda, Important test of Ayurveda and Ayurvedic view of the cause of diseases.	<b>6</b>
II	<b>Nucleic acids and Vitamins</b> Nucleic acids –nucleosides and nucleotides. Structure of DNA - denaturation and renaturation of DNA - replication of DNA. Hydrogen bonding in DNA. Stabilizing forces in protein and DNA - Vander waal's forces, dipole-dipole and dipole-induced dipole	<b>6</b>

	interactions. Structure of RNA - Types of RNA. Difference between DNA and RNA. <b>Vitamins:</b> Classification, source, biological function and deficiency diseases of Vitamin A, B, C, D, E and K.	
III	<b>Lipids, oils and fats</b> Lipids - classification - properties - biological functions. Biological functions of phospholipids and glycolipids. Oils and fats - definition - characteristics and uses. Common fatty acids in oils and fats. Extraction and refining of oils. Estimation of fats and oils - acid value, saponification value and Iodine value. Distinction between animal and vegetable fats. Hydrogenation and Rancidity.	6
IV	<b>Minerals and water</b> <b>Minerals:</b> Introduction – source, function, deficiency and toxicity of calcium, phosphorous, sodium, potassium, iron and iodine. <b>Water:</b> Source and distribution of water in the body – functions of water – absorption, metabolism and storage of water.	6
V	<b>Photochemistry</b> Importance of photochemistry. Difference between thermal and photochemical reactions. Laws of photochemistry -Beer-Lambert's Law - Grother's-Drapers law -Stark-Einstein's law - quantum efficiency. Electronic excitations - singlet and triplet states - Jablonski diagram - internal conversion - intersystem crossing - fluorescence - phosphorescence. Difference between fluorescence and phosphorescence. Photochemical rate law - kinetics of photochemical combination of H <sub>2</sub> and Cl <sub>2</sub> - decomposition of HI. Photosensitization - photosensitizers - chemiluminescence - bioluminescence.	6
	<b>TOTAL</b>	<b>30</b>

<b>Self-study</b>	Nucleic acids, Classification of carbohydrates, RNA and DNA classification of lipids and Electronic excitations
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### Textbooks

1. V.Veeraiyan, 2009,Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition.
2. S.Vaithyanathan, 2012, Text book of Ancillary Chemistry; Priya Publications, Karur.
3. Arun Bahl, B.S.Bahl, 2006,Advanced Organic Chemistry; S.Chandand Company, New Delhi, twenty third edition,.
4. P.L.Soni, H.M.Chawla, 2007, Text Book of Organic Chemistry; SultanChand & sons, New Delhi.

## Reference Books

1. Arun Bahl, B.S.Bahl, 2012, Advanced Organic Chemistry; 23 rd edition, S.Chand and Company, New Delhi.
2. P.L.Soni, H.M.Chawla, 2007, Text Book of Organic Chemistry, 29 th edition, Sultan Chand & sons, New Delhi.
3. B.R.Puri, L.R.Sharma, M.S.Pathania, 2018, Text book Physical Chemistry, 47 th edition ,Vishal Publishing Co., New Delhi.
4. P.L.Soni, Mohan Katyal, 2007, Text book of Inorganic chemistry, 20 th edition, Sultan Chand and Company, New Delhi.
5. P.L.Soni, Mohan Katyal, 2007,Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition.

## Web Resources

1. <https://www.hsph.harvard.edu/nutritionsource/carbohydrates/>
2. <https://my.clevelandclinic.org/health/articles/22243-amino-acids>
3. <https://www.hsph.harvard.edu/nutritionsource/carbohydrates/>
4. <https://my.clevelandclinic.org/health/articles/22243-amino-acids>
5. [https://onlinecourses.nptel.ac.in/noc23\\_cy21/preview](https://onlinecourses.nptel.ac.in/noc23_cy21/preview)

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
<b>CO1</b>	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2
<b>CO2</b>	3	2	2	3	3	2	2	3	2	2	2	2	3	2	2
<b>CO3</b>	3	2	3	3	3	2	2	3	2	2	2	2	2	2	3
<b>CO4</b>	3	2	3	2	2	2	2	3	2	2	2	2	2	3	2
<b>CO5</b>	3	3	3	3	3	2	2	3	2	2	2	2	2	2	2
<b>TOTAL</b>	15	11	13	13	13	10	10	15	10	10	10	10	11	11	11
<b>AVERAGE</b>	3	2.2	2.6	2.6	2.6	2	2	3	2	2	2	2	2.2	2.2	2.2

**3 – Strong, 2- Medium, 1- Low**

## SEMESTER – II

### ELECTIVE LAB COURSE II : SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS BOTANY AND ZOOLOGY MAJOR

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU232EP1			2		2	2	30	25	75	100

#### Prerequisites:

Higher secondary chemistry

#### Learning Objectives

1. To identify of organic functional groups
2. To determine elements in organic compounds.

#### Course Outcomes

On the successful completion of the course, student will be able to:		
1	learn to test the organic substances	<b>K1</b>
2	identify the functional group present in the organic compounds	<b>K2</b>
3	detect the elements present	<b>K3</b>
4	distinguish between aliphatic, aromatic, saturated and unsaturated compounds	<b>K3</b>
5	analyze the given organic substance	<b>K4</b>

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze

Unit	Contents	No. of Hours
I	<b>SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS</b> The analysis must be carried out as follows: (a) Functional group tests [phenol, mono carboxylic acids, ester, aldehyde and carbohydrate]. (b) To distinguish between aliphatic and aromatic compounds. (c) To distinguish – Saturated and unsaturated compounds.	<b>30</b>
<b>TOTAL</b>		<b>30</b>
<b>Self Study</b>	Study of functional groups	

#### Reference Books

1. Thomas, A.O. (1999). Practical Chemistry for B.Sc Main students. Scientific book centre, Cannanore
2. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; 2000, *Vogel's Textbook of Quantitative Chemical Analysis*, 6<sup>th</sup> ed.;

Pearson Education Ltd: New Delhi,.

### Textbooks

- 1 Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R.2002, *Basic Principles of Practical Chemistry*, 2<sup>nd</sup> ed.; Sultan Chand & Sons:, New Delhi.
- 2 Nad, A. K.; Mahapatra, B.; Ghoshal, 2003, *An advanced course in Practical*
3. Thomas, A.O. 1999. *Practical Chemistry for B.Sc Main students*. Scientific book centre, Cannanore.
- 4 Vogel, A.I. 1990. *A Text Book for Qualitative Inorganic Analysis*. The English Language Book Society and Longmans.

### Web Resources

1. [http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis](http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis)
2. <https://chemdictionary.org/titration-indicator/>

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
<b>CO1</b>	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2
<b>CO2</b>	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2
<b>CO3</b>	3	2	3	3	3	2	2	3	2	2	2	2	2	2	2
<b>CO4</b>	3	2	3	2	2	2	2	3	2	2	2	2	2	2	2
<b>CO5</b>	3	3	3	3	3	2	2	3	2	2	2	2	2	2	3
<b>TOTAL</b>	15	12	14	13	13	10	10	15	10	10	10	11	10	10	11
<b>AVERAGE</b>	3	2.4	2.8	2.6	2.6	2	2	3	2	2	2	2.2	2	2	2.2

**3 – Strong, 2- Medium, 1- Low**



## SEMESTER – II

### NON MAJOR ELECTIVE NME II : COSMETICS AND PERSONAL GROOMING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU232NM1	2				2	2	30	25	75	100

**Pre-requisite:**

Students should have elementary knowledge on cosmetics and self-care.

**Learning Objectives:**

1. To provide basic knowledge of the Cosmetics.
2. To know the chemicals, present in hair and skin care products

### Course Outcomes

<b>On the successful completion of the course, student will be able to:</b>		
1.	remember the composition of various chemicals in cosmetic products	<b>K1</b>
2.	understand the methods of beauty treatments and their advantages and disadvantages	<b>K2</b>
3.	apply the functions of various chemicals in cosmetics	<b>K3</b>
4.	analyze the advantages and hazards of cosmetics	<b>K4</b>
5.	evaluate the quality of cosmetics on the basis of their chemical composition	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit	Contents	No. of Hours
I	<b>Skin care</b> Nutrition of the skin, skin care and cleansing of the skin; face powder – ingredients; creams and lotions – cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels – formulation and advantages; astringent and skin tonics – key ingredients, skin lightness, depilatories. Hazards of skin care products.	<b>6</b>
II	<b>Hair care</b> Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients – Hair dye. Disadvantages of hair care products. <b>Dental care</b> Tooth pastes – ingredients and preparation of tooth paste – mouth wash	<b>6</b>
III	<b>Make up</b> Base – foundation – types- liquid - powder – stick. Ingredients, lipstick, eyeliner, mascara, eyeshadow, concealers, rouge.	<b>6</b>
IV	<b>Perfumes</b> Classification - Natural – plant origin – parts of the plant used –	<b>6</b>

	isolation of essential oils – preparation of odorous substances – methyl anthranilate-citronellol-coumarin-vanillin-diphenyl oxide.	
V	<b>Beauty treatments</b> Facials - types – advantages – disadvantages; face masks – types; bleach -types – advantages– disadvantages; shaping the brows; eyelash tinting; perming types; hair colouring and dyeing ; permanent waving – hair straightening; wax types – waxing; pedicure, manicure - advantages – disadvantages	6
<b>TOTAL</b>		<b>30</b>
<b>Self study</b>	Astringent, skin tonics, ingredients of hair dye, Classification of perfumes and hair colouring	

### Text books

1. Thankamma Jacob, 1997. Foods, drugs and cosmetics – A consumer guide, Macmillan publication, London.
2. André ,O. B., Howard, I. M., Marc, P.2009.Handbook of Cosmetic Science and Technology, (Third Edition). CRC Press

### Reference Books

1. George Howard, 1987. Principles and practice of perfumes and cosmetics Stanley Therones, Chettenham.
2. Wilkinson, J. B. E., Moore R. J., 1997. Harry's cosmeticology, (Seventh Edition). Chemical Publishers, London.

### Web Resources

1. <http://www.khake.com/page75.html>
2. <https://www.healthline.com/health/beauty-skin-care/astringent#vs-toner>
3. <https://makeupandbeauty.com/beauty-treatments-home/>

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
<b>CO1</b>	2	3	2	2	2	3	3	2	3	3	2	2	3	2	2
<b>CO2</b>	3	2	2	2	3	2	2	2	3	2	2	2	2	2	2
<b>CO3</b>	2	2	2	3	3	2	2	2	3	3	2	2	2	3	2
<b>CO4</b>	3	2	3	3	2	2	2	2	3	2	2	3	2	2	2
<b>CO5</b>	2	2	3	3	3	2	2	2	3	2	2	3	2	3	2
<b>TOTAL</b>	12	10	12	13	13	11	10	10	15	12	10	12	11	12	10
<b>AVERAGE</b>	2.4	2	2.4	2.6	2.6	2.2	2	2	3	2.4	2	2.4	2.2	2.4	2

**3 – Strong, 2- Medium, 1- Low**

**SEMESTER II**  
**SKILL ENHANCEMENT COURSE SEC I: DAIRY CHEMISTRY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU232SE1	1	-	1	-	2	2	30	25	75	100

**Pre-requisite:**

Higher secondary Chemistry

**Learning Objectives:**

1. To understand the composition and processing of milk.
2. To know the constituents and preparation of milk and milk products.

**Course Outcomes**

On the successful completion of the course, student will be able to:		
1	remember the composition of milk and its processing.	<b>K1</b>
2	understand the physio-chemical properties, pasteurization process and manufacture of milk and milk products	<b>K2</b>
3	apply the procedure for milk processing and determine the adulterants present in dairy products	<b>K3</b>
4	analyze the ingredients, nutritive values and manufacture of special milks and dairy products.	<b>K4</b>
5	evaluate fat, SNF, specific gravity, acidity, pH, surface tension, viscosity and physio-chemical properties of milk and milk products.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Units	Contents	No. of Hours
<b>I</b>	<b>Composition of Milk</b> Milk - definition - general composition of milk - constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity - Factors affecting the composition of milk.	<b>6</b>
<b>II</b>	<b>Processing of Milk</b> Microbiology of milk - destruction of micro - organisms in milk, physico-chemical changes taking place in milk due to processing - boiling, pasteurization - types of pasteurization - Bottle, Batch and High Temperature Short Time (HTST) - Vacuum pasteurization - Ultra High Temperature (UHT) pasteurization.	<b>6</b>
<b>III</b>	<b>Major Milk Products</b> Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream. Butter - definition - composition - theory of churning - desi butter - salted butter, estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection.	<b>6</b>
<b>IV</b>	<b>Special Milk</b>	<b>6</b>

	Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk - Incitation milk - Vegetable toned milk - humanized milk - condensed milk - definition, composition and nutritive value.	
<b>V</b>	<b>Estimation and Preparation of milk and milk products</b> Estimation of fat, SNF, specific gravity and acidity of milk. Determination of pH, surface tension and viscosity of milk. Preparation of butter - ghee - milk powder and ice cream. Preparation of indigenous milk products - khoa - chenna - paneer and kulfi.	<b>6</b>
<b>Total Hours</b>		<b>30</b>

<b>Self-study</b>	General composition and constituents of milk, physico-chemical changes in milk processing, composition of cream, butter and ghee, nutritive value of special milks, Preparation of milk products
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#### Text Books

1. Bagavathi Sundari K., 2006. *Applied Chemistry* (First Edition). MJP Publishers, Chennai.
2. Mathur M.P., Datta Roy, D., Dinakar, P., 2008. *Text Book of Dairy Chemistry* (First Edition). Indian Council of Agricultural Research, New Delhi.
3. Saurav Singh, 2013. *A Text Book of Dairy Chemistry* (First Edition). Daya Publishing House, India.
4. Choudhary P.L., 2021. *Text Book of Dairy Chemistry*. Bio-Green Book Publishers, New Delhi.

#### Reference Books

1. Robert Jenness, Patom, S., 2005. *Principles of Dairy Chemistry*. John Wiley & Sons, New York.
2. Wond, F.P., 2006. *Fundamentals of Dairy Chemistry*. Springer Publications, Singapore.
3. Sukumar De, 2021. *Outlines of Dairy Technology*. Oxford University Press, New Delhi.
4. Fox, P.F., McSweeney, P.L.H., 2016. *Dairy Chemistry and Biochemistry* (Second Edition). Springer Publication, Singapore.
5. Fox, P.F., Uniacke-Lowe, T., McSweeney, P.L.H., O'Mahony, J.A., 2015. *Dairy Chemistry and Biochemistry* (Second Edition). Springer Publication, Singapore.

#### Web Resources

1. <https://authors.library.caltech.edu.in>
2. <http://ecoursesonline.iasri.res.in/course/view.php?id=88>
3. [https://onlinecourses.nptel.ac.in/noc23\\_ag18/preview](https://onlinecourses.nptel.ac.in/noc23_ag18/preview)
4. [https://www.academia.edu/28720946/fundamentals\\_of\\_dairy\\_chemistry\\_3\\_rd\\_edition](https://www.academia.edu/28720946/fundamentals_of_dairy_chemistry_3_rd_edition)
5. <https://www.agrimoon.com/wp-content/uploads/chemistry-of-milk.pdf>
6. [http://students.aiu.edu/submissions/profiles/resources/onlineBook/U7Y2y8\\_Dairy\\_Chemistry\\_and\\_Biochemistry.pdf](http://students.aiu.edu/submissions/profiles/resources/onlineBook/U7Y2y8_Dairy_Chemistry_and_Biochemistry.pdf)

**MAPPING WITH PROGRAMME OUTCOMES  
AND PROGRAMME SPECIFIC OUTCOMES**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>
<b>CO1</b>	3	2	2	3	2	2	3	3	2	2	2	2	3	2	2
<b>CO2</b>	3	3	2	3	2	2	3	3	2	2	2	2	3	2	3
<b>CO3</b>	3	3	2	3	2	2	3	3	3	2	2	2	3	2	3
<b>CO4</b>	3	3	2	3	2	2	3	3	3	2	2	2	3	2	3
<b>CO5</b>	3	3	2	3	2	2	3	3	3	3	2	3	3	2	3
<b>TOTAL</b>	15	14	10	15	10	10	15	15	13	11	10	11	15	10	14
<b>AVERAGE</b>	3	2.8	2	3	2	2	3	3	2.6	2.2	2	2.2	3	2	2.8

**3 – Strong, 2- Medium, 1- Low**

**SEMESTER I & II**  
**Life Skill Training I: Catechism**  
**Course Code: UG232LC1**

Hours	Credit	Total Hours	Total Marks
1	1	30	100

**Objectives:**

1. To develop human values through value education
2. To understand the significance of humane and values to lead a moral life
3. To make the students realize how values lead to success

<b>Course Outcome</b>	<b>Upon completion of this course the students will be able to</b>
CO-1	understand the aim and significance of value education
CO-2	develop individual skills and act confidently in the society
CO-3	learn how to live lovingly through family values
CO-4	enhance spiritual values through strong faith in God
CO-5	learn good behaviours through social values

**Unit I**

**Value Education:**

Human Values – Types of Values – Growth – Components – Need and Importance

Bible Reference: Matthew: 5:3-16

**Unit II**

**Individual Values: Esther**

Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life

Bible Reference: Esther 8:3-6

**Unit III**

**Family Values: Ruth the Moabite**

Respecting Parents – Loving Everyone – Confession – True Love

Bible Reference: Ruth 2:10-13

**Spiritual Values: Hannah**

Faith in God – Wisdom – Spiritual Discipline – Fear in God – Spiritually Good Deeds

Bible Reference: 1 Samuel 1:24-28

**Unit IV**

**Social Values: Deborah**

Good Behaviour – Devotion to Teachers – Save Nature – Positive Thoughts – The Role of Youth in Social Welfare

Bible Reference: Judges 4:4-9

**Unit V**

**Cultural Values: Mary of Bethany**

Traditional Culture – Changing Culture – Food – Dress – Habit – Relationship – Media – The Role of Youth

Bible Reference: Luke 10:38-42

**Text Book**

Humane and Values. Holy Cross College (Autonomous), Nagercoil

The Holy Bible

**SEMESTER I & II**  
**Life Skill Training I: Moral**  
**Course Code: UG232LM1**

Hours	Credit	Total Hours	Total Marks
1	1	30	100

**Objectives:**

1. To develop human values through value education
2. To understand the significance of humane and values to lead a moral life
3. To make the students realize how values lead to success

Course Outcome	Upon completion of this course the students will be able to
CO-1	understand the aim and significance of value education
CO-2	develop individual skills and act confidently in the society
CO-3	learn how to live lovingly through family values
CO-4	enhance spiritual values through strong faith in God
CO-5	learn good behaviours through social values

**Unit I**

**Value Education:**

Introduction – Limitations – Human Values – Types of Values – Aim of Value Education – Growth – Components – Need and Importance

**Unit II**

**Individual Values:**

Individual Assessment – Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life

**Unit III**

**Family Values:**

Life Assessment – Respecting Parents – Loving Everyone – Confession – True Love

**Unit IV**

**Spiritual Values:**

Faith in God – Wisdom – Spiritual Discipline – Fear in God – Spiritually Good Deeds

**Unit V**

**Social Values:**

Good Behaviour – Devotion to Teachers – Save Nature – Positive Thoughts – Drug Free Path – The Role of Youth in Social Welfare

**Unit VI**

**Cultural Values:**

Traditional Culture – Changing Culture – Food – Dress – Habit – Relationship – Media – The Role of Youth

**Text Book**

Humane and Values. Holy Cross College (Autonomous), Nagercoil