Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.
Accredited with A$^+$ by NAAC - IV Cycle – CGPA 3.35

Affiliated to
Manonmaniam Sundaranar University, Tirunelveli

Semester I - IV
UG Guidelines & Syllabus

DEPARTMENT OF CHEMISTRY

2023-2026
(With effect from the academic year 2024-2025)

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

Graduate Attributes

Graduates of our College develop the following attributes during the course of their studies.

- **Creative thinking:**
  Equipping students with hands-on-training through skill-based courses and promote startup.
- **Personality development:**
  Coping with increasing pace and change of modern life through value education, awareness on human rights, gender issues and giving counselling for the needful.
- **Environmental consciousness and social understanding:**
  Reflecting upon green initiatives and understanding the responsibility to contribute to the society; promoting social and cultural diversity through student training and service-learning programmes.
- **Communicative competence:**
  Offering effective communication skills in both professional and social contexts through bridge courses and activities of clubs and committees.
- **Aesthetic skills:**
  Engaging mind, body and emotions for transformation through fine arts, meditation and exercise; enriching skills through certificate courses offered by Holy Cross Academy.
- **Research and knowledge enrichment:**
  Getting in-depth knowledge in the specific area of study through relevant core papers; ability to create new understanding through the process of critical analysis and problem solving.
- **Professional ethics:**
  Valuing honesty, fairness, respect, compassion and professional ethics among students. The students of social work adhere to the *National Association of Social Workers Code of Ethics*
- **Student engagement in the learning process:**
  Obtaining extensive and varied opportunities to utilize and build upon the theoretical and empirical knowledge gained through workshops, seminars, conferences, industrial visits and summer internship programmes.
- **Employability:**
  Enhancing students in their professional life through Entrepreneur development, Placement & Career guidance cell.
- **Women empowerment and leadership:**
  Developing the capacity of self-management, team work, leadership and decision making through gender sensitization programmes.

Programme Educational Objectives (PEOs)

PEOs	Upon completion of B.A/B.Sc. Degree Programme, the graduates will be able to	Mapping with Mission
PEO1	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
PEO2	use practical knowledge for developing professional empowerment and entrepreneurship and societal services.	M2, M3, M4 & M5
PEO3	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
PSO1	understand the fundamentals, theories and principles of organic, inorganic and physical chemistry.	PO1
PSO2	analyze physical and chemical properties of chemical compounds and their uses.	PO1& PO7
PSO3	interpret the mechanism of various chemical reactions.	PO3 &PO4
PSO4	synthesize organic and inorganic compounds using classical and modern methods.	PO2
PSO5	design and carry out scientific experiments, record and interpret the results with accuracy	PO1& PO4
PSO6	use concepts, tools and techniques related to chemistry to other branches of science.	PO5
PSO7	develop skills in the safe-handling of chemicals and their usage in day today life.	PO1&PO7
PSO8	develop entrepreneurial skills, empowered to fulfil the professional requirement and become self-dependent.	PO2& PO6

Mapping of POs and PSOs

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)

Core Courses	Core-Theory	10 x 100	1000
	Core Research Project	1x100	100
	Core Lab Course	5 x 100	500
	Discipline Specific Elective- Theory	3 x 100	300
	Total Marks		**1900**
Elective Courses	Theory	4 x 100	400
	Lab Course	4 x 100/ 2x100*	400/200*
	Total Marks		**800/600***
	Total Marks		**2700/2500***

***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**
Part I –Language	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24	**12**
Part II-English	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24	**12**
Part-III								
Core Course Core Lab Course	5(5) 3(3)	5(5) 3(3)	5(5) 3(3)	5(5) 3(3)	5 (4) + 5 (4) + 5 (4) + -	6 (5) + 6 (5) + 6 (4) + 5 (3)	75	**65**

Core Research 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**
Part IV								
Non-major Elective	2 (2)	2 (2)					4	**4**
Skill Enhancement Course		2 (2)	2(2) + 2 (2)	2 (2)			8	**8**
Foundation Course	2 (2)						2	**2**
Environmental Studies				2 (2)			2	**2**
Value Education					2 (2)		2	**2**
Internship					(2)		-	**2**
Professional Competency Skill						2 (2)	2	**2**
Total	**30 (23)**	**30 (23)**	**30 (23)**	**30 (24)**	**30 (26)**	**30 (22)**	**180**	**140**

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)			2
Student Training Activity: Clubs & Committees / NSS				(1)			1
Community Engagement Activity: RUN				(1)			1
Human Rights Education					(1)		1
Gender Equity Studies						(1)	1
Total							**14**

Total number of Compulsory Credits = Academic credits + Non-academic credits: **140 + 14**

Courses Offered

SEMESTER I

Course	**Course Code**	**Title of the Course**	**Credits**	**Hours /Week**
Part I	TU231TL1 FU231FL1	Language: Tamil French	3	6
Part II	EU241EL1	English: A Stream	3	6
	EU241EL2	English: B Stream		
	EU241EL3	English: C Stream		
Part III	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

Part IV	CU231NM1	Non-Major Elective NME I: Food Chemistry	2	2
	CU231FC1	Foundation Course: Basics of Chemistry	2	2
Total			**23**	**30**

SEMESTER II

Course	Course Code	Title of the Course	Credits	Hours /Week
Part I	TU232TL1 FU232FL1	Language: Tamil French	3	6
Part II	EU242EL1	English: A Stream	3	6
	EU242EL2	English: B Stream		
	EU242EL3	English: C Stream		
Part III	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	3	4
	CU232EP1	Elective Lab Course II: Systematic Analysis of Organic Compounds	2	2
Part IV	CU232NM1	Non-Major Elective NME II: Cosmetics and Personal Grooming	2	2
	CU232SEI	Skill Enhancement Course SEC I: Dairy Chemistry	2	2
Total			**23**	**30**

SEMESTER III

Course	Course Code	Title of the Course	Credits	Hours / Week
Part I	TU233TL1 FU233FL1	Language: Tamil French	3	6
Part II	EU233EL1	English	3	6
Part III	CU233CC1	Core Course III: General Chemistry - III	5	5
	CU233CP1	Core Lab Course III: Organic Analysis and Determination of Physical Constants	3	3
	CU233EC1	Elective Course III: Chemistry for Physical Sciences - I	3	4
	CU233EP1	Elective Lab Course III: Chemistry Practical for Physical Sciences - Volumetric Analysis	2	2
Part IV	CU233SE1	Skill Enhancement Course SEC-II: Applied Chemistry	2	2
	UG23CSE1	Skill Enhancement Course SEC-III: Fitness for Wellbeing	2	2
		Total	**23**	**30**

SEMESTER IV

Course	Course Code	Title of the Course	Credits	Hours / Week
Part I	TU234TL1 FU234FL1	Language: Tamil French	3	6

Part II	EU234EL1	English	3	6
Part III	CU234CC1	Core Course IV: General Chemistry - IV	5	5
	CU234CP1	Core Lab Course IV: Physical Chemistry Practical – I (Conductometric and Potentiometric Titrations)	3	3
	CU234EC1	Elective Course IV: Chemistry for Physical Sciences – II	3	4
	CU234EP1	Elective Lab Course IV: Chemistry Practical for Physical Sciences – Systematic Analysis of Organic Compounds	2	2
Part IV	UG23CSE2	Skill Enhancement Course SEC-IV: Digital Fluency	2	2
	UG234EV1	Environmental Studies (EVS)	2	2
		Total	**23**	**30**

SEMESTER V

Course	Course Code	Title of the Course	Credits	Hours/ Week
Part III	CU235CC1	Core Course V: Organic Chemistry – I	4	5
	CU235CC2	Core Course VI: Inorganic Chemistry – I	4	5
	CU235CC3	Core Course VII: Physical Chemistry -I	4	5
	CU235RP1	Core Research Project	4	5
	CU235DE1	Discipline Specific Elective I: a) Biochemistry	3	4
	CU235DE2	Discipline Specific Elective I: b) Polymer Chemistry		
	CU235DE3	Discipline Specific Elective I: c) Rubber Technology		
	CU235DE4	Discipline Specific Elective II:a) Industrial Chemistry	3	4
	CU235DE5	Discipline Specific Elective II: b) Applied Chemistry		
	CU235DE6	Discipline Specific Elective II: c) Forensic Chemistry		
Part IV	CU235VE1	Value Education	2	2
	CU235IS1	Internship	2	-
Total			**26**	**30**

SEMESTER VI

Course	Course Code	Title of the Course	Credits	Hours/ Week
Part III	CU236CC1	Core Course VIII: Organic Chemistry -II	5	6
	CU236CC2	Core Course IX: Inorganic Chemistry-II	5	6
	CU236CC3	Core Course X: Physical Chemistry -II	4	6
	CU236CP1	Core Lab Course V: Physical Chemistry Practical II	3	5
	CU236DE1	Discipline Specific Elective III: a) Fundamentals of Spectroscopy	3	5
	CU236DE2	Discipline Specific Elective III: b) Fundamentals of organic Spectroscopy		
	CU236DE3	Discipline Specific Elective III: c) Fundamentals of inorganic Spectroscopy		

	CU236PS1	Professional Competency Skill: Chemistry for Competitive Examinations	2	2
Total			**22**	**30**
TOTAL			**140**	**180**

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 –	Skill Development Training (SDT) - Certificate Course	1
	II	CU232FP1	Field Project	1
	I & III	CU231V01 -	Specific Value-added Course	1+1
	II &IV	-	MOOC	1+1
	III & IV	UG234LC1	Life Skill Training II: Catechism	1
		UG234LM1	Life Skill Training II: Moral	
	IV & VI	GVAC2401 -	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
Total				**14**

Specific Value-added Course

Semester	Course code	Title of the course	Credits	Total hours
I	CU231V01	Articles in Every Day Life	1	30
I	CU231V02	Polymer Chemistry	1	30
I	CU231V03	Chemistry of Cosmetics	1	30
III	CU233V01	Agrochemicals and pesticides	1	30
III	CU233V02	Water Resources and Management	1	30
III	CU233V03	Food Adulteration	1	30

Self-Learning Course

Semester	Title of the Course	Course Code
III / V	Nutritional Chemistry	CU233SL1/CU235SL1
IV/ VI	Chemistry of Fuels	CU234SL1/CU236SL1

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.

i. 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
Total	**25**

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 2 x 6 (Internal choice)	12	Part B 5 x 6 (Internal choice)	30
Part C 2 x 12 (Internal choice)	24	Part C 5 x 12 (Internal choice)	60
Total	**40**	**Total**	**100**

ii. 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
Total	**25**

Question pattern

External Exam	**Marks**
Major Practical	75
Minor Practical / Spotters /Record	
Total	**75**

iii. Core Research Project

Ratio of Internal and External = 25:75

Components	**Marks**
Internal	25
External	
Core Research Project Report	40
Viva voce	35
Total	**100**

Part - IV

i. Non-major Elective, Skill Enhancement Course I & II, Foundation Course, Value Education, Professional Competency Skill

Ratio of Internal and External = 2**5: 75**

Internal Components and Distribution of Marks

Components	**Marks**
Internal test (2) – 25 marks	10
Quiz (2) – 20 marks	5
Assignment: (Model Making, Exhibition, Role Play, Album, Group Activity, etc. (Minimum three items per course)	10
Total	**25**

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 **Three** out of **Five**)	12	Part B 5 x 4 (Open choice any **Five** out of **Eight**)	20

Part C 1 x 9 (Open choice **One** out of **Three**)	9	Part C 5 x 9 (Open choice any **Five** out of **Eight**)	45
Total	**25**	**Total**	**75**

ii. Skill Enhancement Course III & IV

Digital Fluency

Components	**Marks**
Internal	
Quiz (15 x 1)	15
Lab Assessment (5 x 2)	10
Total	**25**
External	
Practical (2 x 25)	50
Procedure	25
Total	**75**

Fitness and Wellbeing

Components	**Marks**
Internal	
Quiz (15 x 1)	15
Exercise (2 x 5)	10
Total	**25**
External	
Written Test: Part A: Open choice – 5 out of 8 questions (5 x 5) Part B: Open choice – 5 out of 8 questions (5 x 10)	25 50
Total	**75**

iii. Environmental Studies

Internal Components

Component	**Marks**
Project Report	15
Viva voce	10
Total	**25**

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 **Three** out of **Five**)	12	Part B 5 x 4 (Open choice any **Five** out of **Eight**)	20
Part C 1 x 9 (Open choice **One** out of **Three**)	9	Part C 5 x 9 (Open choice any **Five** out of **Eight**)	45
Total	**25**	**Total**	**75**

iv. Internship

Components	**Marks**
Industry Contribution	50
Report & Viva-voce	50
Total	**100**

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 Activity	25
Total	**50**

External Components

Component	**Marks**
Written Test: Open choice – 5 out of 8 questions (5 x 10)	50
Total	**50**

ii. Skill Development Training - Certificate Course:

Components	**Marks**
Attendance & Participation	50
Skill Test	50
Total	**100**

iii. Field Project:

Components	**Marks**
Field Work	50
Field Project Report & Viva-voce	50
Total	**100**

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

Components	**Marks**
Internal	25
External	75
Total	**100**

v. Student Training Activity: Clubs and Committees

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

Component	**Marks**
Attendance	25
Participation	75
Total	**100**

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

Components	**Marks**
Attendance & Participation	50
Field Project	50
Total	**100**

vii. Self Learning Course

Internal Test	**Marks**	**External Exam**	**Marks**
Part A 3x5 (Three out of five)	15	Part A 5 x 5 (Internal choice)	25
Part B 1 x 10 (One out of three)	10	Part B 5 x 10 (Five out of eight)	50
Total	**25**	**Total**	**75**

Outcome Based Education (OBE)

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

S. No.	**Level**	**Parameter**	**Description**
1	KI	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	1	-	1	1	1	1	-	1	-	-	-	**8**
	External	5	2	1	3	2	2	2	1	2	-	-	-	**20**
II UG	Internal	1	1	-	1	1	1	1	-	1	1	-	-	**8**
	External	5	1	1	4	1	1	-	3	1	1	-	2	**20**
III UG	Internal	1	-	-	1	-	1	1	1	1	1	1	-	**8**
	External	5	1	1	4	1	1	-	3	1	1	-	2	**20**

The levels of assessment are flexible and it should assess the cognitive levels and outcome attainment.

Evaluation

i. The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade points.

ii. 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.

iii. There shall be examinations at the end of each semester, for odd semesters in October/November; for even semesters in April/ May.

iv. 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.

v. Viva-voce: Each project group shall be required to appear for Viva -voce examination in defence of the project.

vi. 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:

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

For the entire programme:

Cumulative Grade Point Average (CGPA) $\Sigma_n\Sigma_i C_{ni}G_{ni} / \Sigma_{ni}\Sigma_i C_{ni}$

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

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.	**K1**
2	understand and classify the elements in the periodic table, types of bonds, reaction intermediates, electronic effects in organic compounds and types of reagents.	**K2**
3	apply the theories to calculate energy of spectral transition, electronegativity, percentage ionic character and bond order.	**K3**
4	analyse the relationship existing between electronic configuration, bonding, geometry of molecules, structure reactivity and electronic effects	**K4**
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.	**K5**

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

Unit	Contents	No. of Hours
I	**Atomic structure and Periodic trends** 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**.**	**15**
II	**Introduction to Quantum mechanics** 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 Ψ and Ψ^2. **Modern Periodic Table** **Cause of periodicity**; 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	**15**

	Paulings scales of electronegativity, applications of electronegativity. Problems involving the core concepts	
III	**Structure and bonding – I** **Ionic bond** 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. **Covalent bond** Shapes of orbitals, overlap of orbitals – σ and Π bonds; hybridization-types-sp,sp^2,sp^3-examples. VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7 Partial ionic character of covalent bond-dipole moment, percentage ionic character- numerical problems based on calculation of percentage ionic character.	**15**
IV	**Structure and bonding – II** VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, CO_3^{2-} NO_3^- limitations of VBT; MO theory - bonding, antibonding and non bonding orbitals, bond order; MO diagrams of H_2, C_2, O_2, O_2^+, O^{2-} , O^{2-}, N_2 , NO, HF, CO; magnetic characteristics, comparison of VB and MO theories. Co-ordinate bond: Definition, Formation of BF_3, NH_3 molecules Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors 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.	**15**
V	**Basic concepts in Organic Chemistry and Electronic effects** Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction 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 methylgroup, dipole moment of aldehydes and nitromethane. Types of organic reactions- addition, substitution, elimination and rearrangements.	**15**
	TOTAL	**75**
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, 2nd 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, 38th 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. 2 0 1 6 . Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi.

Reference Books

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

Web Resources

1. https://onlinecourses.nptel.ac.in
2. http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm
3. 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
CO1	3	2	3	3	2	2	3	3	2	2	2	2	3	3	2
CO2	3	2	3	3	2	2	3	3	3	2	2	2	3	3	2
CO3	3	2	2	3	2	2	3	3	3	3	2	3	3	2	2
CO4	3	2	2	3	2	2	3	3	3	3	2	2	3	2	2
CO5	3	2	2	3	2	2	3	3	3	3	2	2	3	2	2
TOTAL	**15**	**10**	**12**	**15**	**10**	**10**	**15**	**15**	**14**	**13**	**10**	**11**	**15**	**12**	**10**
AVERAGE	**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 LAB COURSE 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.	**K1**
2	compare the methodologies of different titrimetric analysis.	**K2**
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.	**K3**
4	assess the yield of different inorganic preparations and identify the end point of various titrations	**K4**

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

S.No	Contents	No. of Hours
I.	**Chemical Laboratory Safety in Academic Institutions** 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. **Common Apparatus Used in Quantitative Estimation (Volumetric)** 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. **Principle of Quantitative Estimation (Volumetric)** 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.	**15**
2.	**Quantitative Estimation(Volumetric)** Preparation of standard solution, dilution from stock solution **Permanganometry** Estimation of oxalic acid using standard ferrous ammonium sulphate **Dichrometry** Estimation of Ferrous Ammonium Sulphate using standard dichromate	**15**

	(external indicator) Estimation of Ferrous Ammonium Sulphate using standard dichromate (internal indicator) **Iodometry** Estimation of copper in copper sulphate using standard dichromate **Argentometry** Estimation of chloride in barium chloride using standard sodium chloride/	
3.	**Complexometry** Estimation of hardness of water using EDTA Estimation of Zinc using EDTA Estimation of Magnesium using EDTA Estimation of Lead using EDTA **Preparation of Inorganic compounds** Potash alum Tetra ammine copper (II) sulphate Prussian Blue Mohr's Salt	**15**
	TOTAL	**45**
Self study	Equivalent weight and Calculation of normality	

Textbooks

1.Venkateswaran, V., R. Veeraswamy, A.R. Kulandivelu. 1997. Basic Principles ofPractical Chemistry, 2nd ed., Sultan Chand &Sons, New Delhi

2.Nad, A. K., B. Mahapatra, A. Ghoshal.,2002.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 Book

1. Mendham, J., R.C. Denney, J.D. Barnes, M. Thomas, B. Sivasankar. 2000, Vogel's Textbook of Quantitative Chemical Analysis, 6th ed.; PearsonEducation 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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	2
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	2	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	3
TOTAL	**15**	**12**	**14**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**11**	**10**	**10**	**11**
AVERAGE	**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
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:		
1	remember the atomic structure, the preparation and uses of various compounds	K1
2	understand the efficiencies and uses of various drugs, fertilizers and fuels.	K2
3	explain and apply various theories behind osmosis, catalysis and chromatography	K3
4	differentiate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.	K4
5	analyse various methods to separate chemical compounds	K4

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

Unit	Contents	No. of Hours
I	**Atomic Structure** 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. 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.	12
II	**Industrial Chemistry** Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.	12
III	**Biophysical Analysis and Catalysis** 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	**Drugs and Speciality Chemicals** 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	**Analytical Chemistry** Introduction qualitative and quantitative analysis. Principles ofvolumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.	**12**
TOTAL		**60**
Self Study	Electronic configuration of elements, Properties and uses of silicones, Types of Catalysis, Artificial sweetners 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_

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	2	3	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	3
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	3	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	2
TOTAL	**15**	**11**	**13**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**10**	**11**	**11**	**11**
AVERAGE	**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 LAB COURSE 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.

Curse Outcomes

On the successful completion of the course, student will be able to:		
1	understand the principles of titrimetric methods.	**K1**
2	gain knowledge on the usage of standard flask, pipette and burette.	**K2**
3	design, carry out, record and interpret the results of various titrations and apply their skill in the estimation of various compounds.	**K3**
4	analyze the suitable indicators for various titrations	**K4**

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

Contents	No. of Hours
VOLUMETRIC ANALYSIS 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of sulphuric acid acid using standard oxalic acid. 3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate. 5. Estimation of zinc using EDTA. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using potassium dichromate.	**30**
TOTAL	**30**
Self Study Demonstration	

Textbooks

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 PracticalChemistry; 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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	2
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	2	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	3
TOTAL	**15**	**12**	**14**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**11**	**10**	**10**	**11**
AVERAGE	**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.	**K1**
2	understand the effect of chemicals in common food and their adverse impact on health.	**K2**
3	apply various methods to detect various adulterants in food and to determine the values of oils and fats.	**K3**
4	analyze the effects of contaminants and additives in food.	**K4**

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

Unit	Contents	No. of Hours
I	**Food Adulteration** 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	**Food Poison** Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) -Chemical poisons - First aid for poison consumed victims.	**6**
III	**Food Additives** Food additives - artificial sweeteners-Saccharin-Cyclomate and Aspartate-Food flavours - esters, aldehydes and heterocyclic compounds – Food colours – Emulsifying agents – preservatives -leavening agents. Baking powder – yeast – tastemakers – MSG - vinegar.	**6**
IV	**Beverages** Beverages-soft drinks-soda-fruit juices-alcoholic beverages-examples. Carbonation-addiction to alcohol– diseases of liver and social problems.	**6**
V	**Edible Oils** 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, saponification values and their significance- Role of MUFA and PUFA in preventing heart diseases.	**6**
	Total	**30**

Self study	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
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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	2	3	2	2	3	2	3	2	2	3	2	2	2	2
CO2	3	2	3	3	3	2	2	3	2	2	3	2	2	3	2
CO3	3	2	3	3	3	2	2	3	2	2	2	3	2	2	2
CO4	3	2	3	2	2	2	2	3	2	2	3	2	2	2	2
CO5	3	2	3	2	3	2	2	3	2	2	2	2	2	3	2
TOTAL	**15**	**10**	**15**	**12**	**13**	**11**	**10**	**15**	**10**	**10**	**13**	**11**	**10**	**11**	**10**
AVERAGE	**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:		
1	remember the basic concepts of periodic classification, chemical bonding, nomenclature of organic compound, isomerism and state of matter.	**K1**
2	understand the periodic properties, types of bonding, hybridization, stereo isomerism, properties of matter and spectroscopy.	**K2**
3	apply the concepts of valence bond theory, hybridization, isomerism IUPAC nomenclature and spectroscopy to chemical compounds.	**K3**
4	analyze the periodic properties of elements, magnetic properties, characteristic of solids and types of spectroscopic techniques.	**K4**
5	evaluate quantum numbers and their significance and percentage of ionic character of compounds.	**K5**

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

Units	Contents	No. of Hours
I	**Structure of atom and periodic classification of Elements and properties** 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.	**6**
II	**Chemical Bonding** 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).	**6**
III	**Nomenclature and Isomerism in Organic compounds** Carbon compounds - Uniqueness of carbons - Classification of hydrocarbons - IUPAC Nomenclature of Organic compounds Isomerism: Structural and Stereoisomerism Structural Isomerism: Chain isomerism, Functional isomerism, Positional isomerism and Meta isomerism. Stereoisomerism: Geometrical and Optical isomerism - Chiral molecule - Enantiomers - Diastereomers - Meso compounds - Racemic mixture.	**6**
IV	**States of Matter**	**6**

	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.	
V	**Introduction to Spectroscopy** 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.	**6**
	Total	**30**
Self-study	Periodic table - periodic laws (Mendeleev and Mosley) ,Types of chemical bonds, Classification of hydrocarbons ,Characteristics of solids, Electromagnetic radiation and general characteristics of Wave	

Textbooks

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	2	2	2	2	2	3	3	2	2	2	2	2	2	2
CO2	3	2	2	2	2	2	3	3	2	2	2	2	3	2	2
CO3	3	2	2	2	2	2	3	3	3	2	2	2	3	2	2
CO4	3	2	2	2	2	2	3	3	3	2	2	2	3	2	2
CO5	3	2	2	2	2	2	3	3	3	2	2	2	3	2	2
TOTAL	**15**	**10**	**10**	**10**	**10**	**10**	**15**	**15**	**13**	**10**	**10**	**10**	**14**	**10**	**10**
AVERAGE	**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	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU231V01	2	-	-	-	1	2	30	25	75	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:		
1	know about oils, fats and soaps	**K1**
2	understand the methods to prepare some articles in daily use	**K2**
3	apply the prepared things in daily life	**K3**
4	remember the hazards of chemicals	**K2**
5	analyze and use the safety compounds for their use	**K4**

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

Unit	Contents	No. of Hours
I	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.	**6**
II	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.	**6**
III	Perfumes-definition- classification as natural and synthetic-composition or ingredients. Fixatives: Name of the oil, source, components.	**6**
IV	Tooth paste, tooth powder, boot polish, gum paste, sealing wax, phenoyle, moth balls, liquid blues, chalk crayons, inks, agarpattis and camphor tablets	**6**
V	Preparation, properties and uses of washing soda, baking powder ,vinegar , bleaching powder, shampoo, washing powder and sugar.	**6**
	Total	**30**

Self-study	Fixatives, Detergents

Textbooks:

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

Reference Books

1. Mitchell Schlossman.2008. *Chemistry and manufacture of Cosmetics* , Science Edition,
2. Marsh, Madeleine.2014. *Compacts and Cosmetics*: Beauty from Victorian Times to the Present Day. Casemate Publishers.

Web Resources

1. https://www.sciencedirect.com>topics>materials
2. https://www.afmworkshop.com>applications
3. https://www.cosmeticsandskin.com>references
4. https://taylorandfrancis.com>

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	2
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	2	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	3
TOTAL	**15**	**12**	**14**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**11**	**10**	**10**	**11**
AVERAGE	**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

SPECIFIC VALUE-ADDED COURSE: POLYMER CHEMISTRY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU231V02	2	-	-	-	1	2	30	25	75	100

Pre-requisite: Knowledge about polymers

Learning Objectives

1.To know about the different types of polymers.

2.To understand the importance and the biomedical application of polymers

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	to know about different polymers	**K1**
2.	understand the properties of polymers	**K2**
3.	use the methods and synthesis of polymers and plastics	**K3**
4.	analyse the properties and uses of polymers, plastics and resins	**K4**
5.	evaluate the types of polymers, methods of synthesis and applications	**K5**

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

Units	Contents	No. of Hours
I	General characteristics of polymers. Distinction among plastics, elastomers and fibres Homo and hetero polymers, copolymers. Plastics: thermosetting and thermo plastics.Type of polymerization – addition, condensation and co-polymerization.	**6**
II	Methods of polymerization – bulk, suspension, emulsion and solution polymerization. Synthesis, properties and application of the following polymers - Phenol – formaldehyde resin, Melamine – formaldehyde resin, Polyurethane's, Epoxy resins.	**6**
III	Synthetic polymers – poly ethylene – HDPE, LDPE, LLDPE, poly propylene, poly vinyl chloride – grades of PVC, Teflon, polyesters, polyamide – Nylon 66. Natural polymers – cellulose, starch, cellulose acetate and cellulose nitrate.	**6**
IV	Synthesis of monomers – terephthalic acid, DTM, Caprolactam, hexamethylene diamine, ethylene glycol, adipic acid and acrylonitrile. Properties-Viscosity, Solubility, optical, electrical, thermal and mechanical properties of polymers.	**6**
V	Degradation of polymers by thermal, oxidative, mechanical and chemical methods. Polymer processing – compression moulding, injection moulding, transfer moulding, extrusion moulding, casting, extrusion of fibres and spinning.	**6**
	Total	**30**

Self-study	Types of polymers, Properties of polymers

Textbooks

1. Bhatnagar M.S 2004. *A text book of Polymers,* S. Chand and Company Ltd., New Delhi
2. Gowariker V.R Viswanathan N.V and Jayadev Sreedhar.1986. *Polymer Chemistry*, New Age International (P) Ltd., India.

Reference Books

1. Bill Meyer F.W. 1984. *Text book of Polymer Science*, John Wiley and Sons.
2. Arora G.D .2010. *Polymer Chemistry*, Sarup Book Publishers Pvt. Ltd.
3. Misra.G.1996. *Introductory Polymer Chemistry*, New Age International (P) Ltd., Publishers.
4. Fred. W, Billmeyer. J.R .1994.*A text book of Polymer Science*, John Wiley and Sons,.
5. John W.Nicholson 1985. *The Chemistry of polymers*,Royal society of polymers,Cambridge, UK.

Web Resources

1.https://www.rsc.org>polymer- chemistry

2.https://www.rsc.org>applied polymers
3.https://www.sciencedirect.com>topics>materials
4.https://www.afmworkshop.com>applications
5.https://www.sciencedirect.com>topics>polymer-chemistry

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	1	2	3	3	2	2	3	3	2	2	2	3	3	3
CO2	3	3	1	2	3	2	3	3	3	2	2	2	3	3	3
CO3	3	2	2	2	3	2	3	3	3	3	3	1	2	2	3
CO4	3	2	2	2	3	2	3	3	3	3	3	2	3	2	3
CO5	3	2	3	3	1	2	3	3	3	3	3	3	3	3	3
TOTAL	**15**	**10**	**10**	**10**	**13**	**10**	**14**	**15**	**15**	**13**	**13**	**10**	**14**	**13**	**15**
AVERAGE	**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 I

SPECIFIC VALUE-ADDED COURSE: CHEMISTRY OF COSMETICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU231V03	2	-	-	-	1	2	30	25	75	100

Pre-requisite: Students should have knowledge on Chemicals and Cosmetics

Learning Objectives:

1. To know the preparation of Cosmetics.
2. To understand the harmful effects of the ingredients in Cosmetics.

On the successful completion of the course, students will be able to:		
1.	to know about different cosmetics like face creams, nailpolish, hair oil and soaps	**K1**
2.	understand the properties of different chemicals in cosmetics	**K2**
3.	predict the applications of cosmetics in daily life	**K3**
4.	analyse the properties and uses of different cosmetics	**K4**
5.	evaluate the hazards of different cosmetics	**K5**

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

Units	Contents	No. of Hours
I	Face creams – types – cold cream – basic formula – preparation – special additives – uses – vanishing cream – formulation – preparation and uses. Face powders – types – composition – hand lotion and creams – making a simple hand lotion and cream.	**6**
II	Nail polish preparation – Nail bleach, nail lacquers – film forming substances – plasticizers – solvents – colourants – make up preparation – lipstick – composition – Rouge – types and formulation – eye makeup – mascara.	**6**
III	Dentifrices – types – composition – use -detergents in dentifrices – sodium N-lauryl sarcosinate – humectants – binders – flavours – special ingredients in dentifrices – fluoride– chlorophyll – peroxide – antibacterials.	**6**
IV	Shaving soaps – composition – brushless shaving creams – ingredients used , toilet soaps – types – composition – preparation – transparent soaps – special ingredients in toilet soaps.	**6**
V	Hair oil –hair tonics – special ingredients in hair oil and tonics – hair creams – shampoos – types - special ingredients in shampoos – hair dyes -hazards of cosmetics – quality control of cosmetics in India.	**6**
	Total	**30**

Self-study	Hazards of creams, oils and make-up chemicals

Textbooks

1. Thankamma Jacob. 1979. *Applied Chemistry for Home Science and Allied Sciences*, Macmillan Company,.
2. Arun Bahl. S. 2013. *Advanced Organic Chemistry*, Chand & Company,

Reference Books

1.Bilensoy, Erem. 2011. *Cyclodextrins in Pharmaceutics, Cosmetics, and Biomedicine :* Current and Future Industrial Applications. John Wiley & Sons,
2. Mitchell Schlossman.2008. *Chemistry and manufacture of Cosmetics* , Science Edition,

3. Marsh, Madeleine.2014. *Compacts and Cosmetics*: Beauty from Victorian Times to the Present Day. Casemate Publishers.
4. Pallingston, J 1998. *Lipstick: A Celebration of the World's Favourite Cosmetic*. St. Martin's Press.
5. Angeloglou, 1970. Maggie. *The History of Make-up*. First ed. Great Britain: The Macmillan Company,

Web Resources

1. https://www.cosmeticsandskin.com>references
2. https://taylorandfrancis.com>
3. https://www.grafiati.com>literature-selections>cosmetics
4. https://www.juestrich-cosmetics.ch>cosmetics-references
5. https://citationssy.com>Style Guides

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	2
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	2	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	3
TOTAL	**15**	**12**	**14**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**11**	**10**	**10**	**11**
AVERAGE	**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

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

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

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

Units	Contents	No. of Hours
I	**Acids, bases and Ionic equilibria** 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.	**15**
II	**Chemistry of s and p - Block Elements** 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 & 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.	**15**
III	**Chemistry of P Block Elements (Group 15-18)** General characteristics of elements of Group 15; chemistry of H_2N-NH_2,	**15**

	NH_2OH and HNO_3. Chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4). General properties of elements of group16 - 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 electro-negativity, electron affinity and oxidation states. Peculiarities of fluorine. Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens. Noble gases: Position in the periodic table-uses of noble gases.	
IV	**Hydrocarbon Chemistry-I** Petroproducts: Fractional distillation of petroleum; cracking, Alkenes-Nomenclature, general methods of preparation – Mechanism of β- elimination reactions – E_1 and E_2 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.	**15**
V	**Hydrocarbon Chemistry - II** 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.	**15**
	Total	**75**

Self-study	General characteristics of s and p block elements and hydrocarbons

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

Reference Books

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

Web Resources

1. https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lec

ture_notes/4B.html
2. http://nptel.ac.in/courses/104101090/Classification of elements and periodic properties http://nptel.ac.in/courses/104101090/
3. http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64 -atomic-structure-and-chemical-bonding MOOC components
4. https://en.m.wikipedia.org
5. 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
CO1	3	1	2	3	3	2	2	3	3	2	2	2	3	3	3
CO2	3	3	1	2	3	2	3	3	3	2	2	2	3	3	3
CO3	3	2	2	2	3	2	3	3	3	3	3	1	2	2	3
CO4	3	2	2	2	3	2	3	3	3	3	3	2	3	2	3
CO5	3	2	3	3	1	2	3	3	3	3	3	3	3	3	3
TOTAL	**15**	**10**	**10**	**10**	**13**	**10**	**14**	**15**	**15**	**13**	**13**	**10**	**14**	**13**	**15**
AVERAGE	**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	**K1**
2.	know the methods of preparing organic compounds.	**K2**
3.	assess the yield of different organic preparations	**K3**
4.	compare the methodologies in preparing various compounds	**K4**

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

S.No	Contents
I	**Organic estimation** 1. Estimation of Phenol 2. Estimation of Aniline 3. Estimation of Ethyl methyl ketone – course work
II	**Preparation of Organic Compounds** 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

Textbooks

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	2	3	3	2	2	3	3	2	2	2	2	3	3	2
CO2	3	2	3	3	2	2	3	3	3	2	2	2	3	3	2
CO3	3	2	2	3	2	2	3	3	3	3	2	3	3	2	2
CO4	3	2	2	3	2	2	3	3	3	3	2	2	3	2	2
TOTAL	**12**	**8**	**10**	**12**	**8**	**8**	**12**	**12**	**11**	**10**	**8**	**9**	**12**	**10**	**8**
AVERAGE	**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:		
1	remember the importance of amino acids and learn the . basic concepts of Ayurveda	**K1**
2	understand the importance of nucleic acids and vitamins	**K2**
3	know the biological functions of lipids, oils and fats	**K1**
4	understand the function and deficiency of metals in human system	**K2**
5	outline the various type of photochemical process.	**K3**

K1 - Remember; K2 - Understand; K3 - Apply

Unit	Contents	No. of Hours
I	**Amino Acids and Essential elements of biosystem** 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.	**6**
II	**Nucleic acids and Vitamins** 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 interactions. Structure of RNA - Types of RNA. Difference between DNA and RNA. **Vitamins**: Classification, source, biological function and deficiency diseases of Vitamin A, B, C, D, E and K.	**6**
III	**Lipids, oils and fats** 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	**Minerals and water** **Minerals:** Introduction – source, function, deficiency and toxicity of calcium, phosphorous, sodium, potassium, iron and iodine. **Water**: Source and distribution of water in the body – functions of water – absorption, metabolism and storage of water.	**6**
V	**Photochemistry**	**6**

	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_2 and Cl_2 - decomposition of HI. Photosensitization - photosensitizers - chemiluminescence - bioluminescence.	
	TOTAL	**30**

Self-study	Nucleic acids, Classification of carbohydrates, RNA and DNA classification of lipids and Electronic excitations

Textbooks

1. Veeraiyan V, 2009,Textbook of Ancillary Chemistry; High mountpublishing house, Chennai, first edition.
2. Vaithyanathan S, 2012, Text book of Ancillary Chemistry; PriyaPublications, Karur.
3. Arun Bahl, B.S.Bahl, 2006,Advanced Organic Chemistry; S.Chandand Company, New Delhi, twenty third edition,.
4. Soni P.L, 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. Soni P.L., Chawla H.M., 2007, Text Book of Organic Chemistry, 29 th edition, Sultan Chand & sons, New Delhi.
3. Puri B.R.,.Sharma L.R, Pathania M.S., 2018, Text book Physical Chemistry, 47 th edition ,Vishal Publishing Co., New Delhi.
4. Soni P.L., Mohan Katyal, 2007, Text book of Inorganic chemistry, 20 th edition, Sultan Chand and Company, New Delhi.

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	2	3	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	3
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	3	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	2
TOTAL	**15**	**11**	**13**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**10**	**11**	**11**	**11**
AVERAGE	**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	**K1**
2	identify the functional group present in the organic compounds	**K2**
3	detect the elements present	**K3**
4	distinguish between aliphatic, aromatic, saturated and unsaturated compounds	**K3**
5	analyze the given organic substance	**K4**

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

Unit	Contents	No. of Hours
I	**SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS** 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.	**30**
TOTAL		**30**
Self Study	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*, 6th ed.; Pearson Education Ltd: New Delhi,.

Textbooks

1 Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R.2002, *Basic Principles of Practical Chemistry*,2nd 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
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
CO1	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	2
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	2	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	3
TOTAL	**15**	**12**	**14**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**11**	**10**	**10**	**11**
AVERAGE	**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

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

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

Unit	Contents	No. of Hours
I	**Skin care** 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.	**6**
II	**Hair care** Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner –types – ingredients – Hair dye. Disadvantages of hair care products. **Dental care** Tooth pastes – ingredients and preparation of tooth paste – mouth wash	**6**
III	**Make up** Base – foundation – types- liquid - powder – stick. Ingredients, lipstick, eyeliner, mascara, eyeshadow, concealers, rouge.	**6**
IV	**Perfumes** Classification - Natural – plant origin – parts of the plant used – isolation of essential oils – preparation of odorous substances – methyl anthranilate-citronellol-coumarin-vanillin-diphenyl oxide.	**6**
V	**Beauty treatments** 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**
TOTAL		**30**
Self study	Astringent, skin tonics, ingredients of hair dye, Classification of perfumes and hair colouring	

Textbooks

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
CO1	2	3	2	2	2	3	3	2	3	3	2	2	3	2	2
CO2	3	2	2	2	3	2	2	2	3	2	2	2	2	2	2
CO3	2	2	2	3	3	2	2	2	3	3	2	2	2	3	2
CO4	3	2	3	3	2	2	2	2	3	2	2	3	2	2	2
CO5	2	2	3	3	3	2	2	2	3	2	2	3	2	3	2
TOTAL	**12**	**10**	**12**	**13**	**13**	**11**	**10**	**10**	**15**	**12**	**10**	**12**	**11**	**12**	**10**
AVERAGE	**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.	**K1**
2	understand the physio-chemical properties, pasteurization process and manufacture of milk and milk products	**K2**
3	apply the procedure for milk processing and determine the adulterants present in dairy products	**K3**
4	analyze the ingredients, nutritive values and manufacture of special milks and dairy products.	**K4**
5	evaluate fat, SNF, specific gravity, acidity, pH, surface tension, viscosity and physio-chemical properties of milk and milk products.	**K5**

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

Units	Contents	No. of Hours
I	**Composition of Milk** 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.	**6**
II	**Processing of Milk** 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.	**6**
III	**Major Milk Products** 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.	**6**
IV	**Special Milk** 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.	**6**
V	**Estimation and Preparation of milk and milk products** Estimation of fat, SNF, specific gravity and acidity of milk. Determination of pH, surface tension and viscosity of milk. Preparation of butter - ghee - milk	**6**

	powder and ice cream. Preparation of indigenous milk products - khoa - chenna - paneer and kulfi.	
	Total	**30**

Self-study	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

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 Chem*istry (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, NewDelhi.
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
4. 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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	2	2	3	2	2	3	3	2	2	2	2	3	2	2
CO2	3	3	2	3	2	2	3	3	2	2	2	2	3	2	3
CO3	3	3	2	3	2	2	3	3	3	2	2	2	3	2	3
CO4	3	3	2	3	2	2	3	3	3	2	2	2	3	2	3
CO5	3	3	2	3	2	2	3	3	3	3	2	3	3	2	3
TOTAL	**15**	**14**	**10**	**15**	**10**	**10**	**15**	**15**	**13**	**11**	**10**	**11**	**15**	**10**	**14**
AVERAGE	**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	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG232LC1	1	-	-	-	1	1	15	50	50	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

On the successful completion of the course, student will be able to:		
1	understand the aim and significance of value education	K1,K2
2	develop individual skills and act confidently in the society	K3
3	learn how to live lovingly through family values	K3
4	enhance spiritual values through strong faith in God	K6
5	learn good behaviours through social values	K6

K1 - Remember **K2**-Understand; **K3**-Apply; **K6**- Create

Units	Contents	No. of Hours
I	**Value Education:** Human Values – Types of Values – Growth – Components – Need and Importance - Bible Reference: Matthew: 5:3-16	3
II	**Individual Values: Esther** Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life - Bible Reference: Esther 8:3-6	3
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	3
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	3
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	3
	Total	15

Textbook

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

SEMESTER I & II
LIFE SKILL TRAINING I: MORAL

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG232LM1	1	-	-	-	1	1	15	50	50	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 Outcomes

On the successful completion of the course, student will be able to:		
1	understand the aim and significance of value education	K1, K2
2	develop individual skills and act confidently in the society	K3
3	learn how to live lovingly through family values	K3
4	enhance spiritual values through strong faith in God	K6
5	learn good behaviours through social values	K6

K1 - Remember **K2**-Understand; **K3**-Apply; **K6**- Create

Units	Contents	No. of Hours
I	**Value Education:** Introduction – Limitations – Human Values – Types of Values – Aim of Value Education – Growth – Components – Need and Importance	3
II	**Individual Values:** Individual Assessment – Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life.	3
III	**Family Values:** Life Assessment – Respecting Parents – Loving Everyone – Confession – True Love.	3
IV	**Spiritual Values:** Faith in God – Wisdom – Spiritual Discipline – Fear in God – Spiritually Good Deeds.	3
V	**Social Values:** Good Behaviour – Devotion to Teachers – Save Nature – Positive Thoughts – Drug Free Path – The Role of Youth in Social Welfare. **Cultural Values**: Traditional Culture – Changing Culture – Food – Dress – Habit – Relationship – Media – The Role of Youth.	3
	Total	15

Textbook

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

SEMESTER III

CORE COURSE III: GENERAL CHEMISTRY III

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233CC1	5	-	-	-	5	5	75	25	75	100

Pre-requisite: General Chemistry – I and II

Learning Objectives:

1. To know the properties of applications of chemical compounds
2. To analyse the kinetics of gases, crystal systems, nuclear radioactivity and chemical reactions

Course Outcomes

On the successful completion of the course, students will be able to:		
1	remember the classification and properties of chemical compounds	**K1**
2	understand the basic concepts of states of matter, nuclear radioactivity and organic reactions	**K2**
3	apply the concepts and mechanism in gases, liquids, solids, radioactivity and organic reactions	**K3**
4	analyze the properties of gases, liquids, solids and mechanisms of chemical reactions	**K4**
5	evaluate the kinetics of gases, crystal structure, nuclear reactions and properties of organic reactions	**K5**

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

Units	Contents	No. of Hours
I	**Gaseous state** General characteristics of gases - postulates and derivation from the kinetic gas equation - The Maxwell-Boltzmann distribution of speed of molecules - average, root mean square and most probable velocity and average kinetic energy. Collision frequency - collision diameter - mean free path and viscosity of gases. Real gases - deviations from ideal gas behaviour compressibility factor - Z and its variation with pressure for different gases. Equations of states for real gases - Virial equation and van der waal's equation	15
II	**Liquid and Solid State** Properties of liquids - surface tension and viscosity. Crystalline and amorphous - isotropy and anisotropy - isomorphism and polymorphism. Crystals - size and shape - symmetry elements - plane, centre and axis - Miller indices - unit cells and space lattices. Classification of crystal systems - Bravais lattices - X - ray diffraction and Bragg's equation. Packing in atomic solids - simple cubic - body centered cubic - face centered and hexagonal close packing. Co-ordination number in typical structures - NaCl - CsCl - ZnS and TiO_2. Structure and properties of diamond and graphite. Defects in solids - stoichiometric and nonstoichiometric defects.	15
III	**Nuclear Chemistry** Natural radioactivity - α, β and γ rays - half-life period - Fajan-Soddy group displacement law - Geiger-Nattal rule - isotopes - isobars - isotones - nuclear isomerism - radioactive decay series - magic numbers - units - Curie - Rutherford - Roentgen - nuclear stability - neutron-proton ratio - binding energy - packing fraction and mass defect. Derivation of decay constant - half-life period and radiocarbon dating. Nuclear energy - nuclear fission and fusion - major nuclear reactors in India -	15

	radiation hazards - disposal of radioactive waste and safety measures. Applications of radioactivity in medicine, agriculture and industry.	
IV	**Halogen Compounds** **Aliphatic halogen compounds** General methods of preparation - physical and chemical properties. Mechanism and stereochemistry of aliphatic S_N1 and S_N2 reactions. Difference between S_N1 and S_N2 mechanism. Factors influencing the rate of aliphatic nucleophilic substitution reaction. Preparation - properties and uses of chloroform - iodoform and carbon tetrachloride. **Aromatic halogen compounds** General methods of preparation - physical and chemical properties. properties of aryl halides. Mechanism of aromatic S_N1, S_N^{Ar} and benzyne reactions. Preparation - properties and uses of D.D.T and B.H.C	**15**
V	**Alcohols and Phenols** **Alcohols** General methods of preparation - physical and chemical properties. Ascent and descent series. Preparation - properties and uses of allyl alcohol, ethylene glycol and glycerol. Estimation of number of hydroxyl groups in polyhydroxy alcohols. **Phenols** General methods of preparation - physical and chemical properties. Acidic character of phenol and effect of substituent on the acidity of phenol. Electrophilic substitution reactions - Reimer-Tiemann - Kolbe-Schmidt - Gatermann synthesis - Libermann nitroso and phthalein reactions. Preparation, properties and uses of catechol - resorcinol - quinol and pyrogallol.	**15**
	Total	**75**

Self-study	Nomenclature and classification of halogen derivatives , phenols and alcohols

Textbooks:

1. Puri, B.R., Sharma, L.R., Pathania, M.S., 2020. *Principles of Physical Chemistry*, (47th Edition), Vishal Publishing Co., India.
2. Puri, B.R., Sharma, L.R., Kalia, K.C., 2020. *Principles of Inorganic Chemistry*, (31st Edition), Vishal Publishing Co., India.
3. Arnikar, H.J., 2011. *Essentials of Nuclear Chemistry*, (4th Edition), New Age International Private Limited, India.
4. Jain, M.K., Sharma, S.C., 2024. *Modern Organic Chemistry*, Vishal Publishing Co., India.
5. Morrison, R.T., Boyd, R.N., Bhattacharjee, S.K., 2010. *Organic Chemistry*, (7th Edition), Pearson Education, India.

Reference Books:

1. Atkins, P., De Paula, J., 2014. *Physical Chemistry*, (10th Edition), Oxford University Press, Oxford.
2. Bahl, B.S., Tuli, G.D., Bahl, A., 2020. *Essentials of Physical Chemistry*, (24th Edition), S. Chand and Company Limited, India.
3. Madan, R.D., 2014. *Modern Inorganic Chemistry*, (13th Edition). Sultan Chand Publishing Limited, India.
4. Lee, J.D., 2005. *Concise Inorganic Chemistry*, (5th Edition), Wiley Blackwell Science, U.S.A
5. Soni, P.L., 2012. *Text book of Organic Chemistry*, (29th Edition). Sultan Chand & Sons Publishing, India.

Web Resources:

1. https://www.khanacademy.org/science/chemistry/gases-and-kinetic-molecular-theory
2. https://www.khanacademy.org/science/ap-chemistry

3. https://study.com/academy/lesson/how-atoms-molecules-form-solids-patterns-crystals.html
4. https://gchem.cm.utexas.edu/nuclear/index.php#opening-statement.php
5. https://www.vedantu.com/chemistry/preparation-alkyl-halides

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

3 – Strong, 2- Medium, 1- Low

SEMESTER III

CORE LAB COURSE III: ORGANIC ANALYSIS AND DETERMINATION OF PHYSICAL CONSTANTS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233CP1	-	-	3	-	3	3	45	-	75	100

Pre-requisite: Organic compounds and their functional groups

Learning Objectives:

1. To identify the functional groups in organic compounds through qualitative tests
2. To determine the physical constants of organic compounds

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember the basic concepts of organic analysis	**K1**
2	understand the methods to identify the functional groups	**K2**
3	apply the procedure for identifying the functional groups	**K3**
4	analyse the functional groups and physical constants of organic compounds	**K4**
5	evaluate the melting and boiling points of organic compounds	**K5**

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

Contents	No. of Hours
A. Qualitative Organic Analysis i) Preliminary examination, detection of special elements - nitrogen, sulphur and halogens ii) Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests iii) Confirmation of functional groups • monocarboxylic acid, dicarboxylic acid • monohydric phenol, polyhydric phenol • aldehyde, ketone, ester • carbohydrate • primary amine • monoamide, diamide iv) Preparation of derivatives for functional groups **Demonstration** **B. Determination of melting/boiling point of organic compounds.**	**45**

Self Study	Theory behind the preparation of organic compounds and melting/boiling point of organic compounds

Textbooks

1. Venkateswaran, V.Veeraswamy, R., Kulandaivelu, A.R., 2012, *Basic Principlesof Practical Chemistry*, (Second edition), Sultan Chand, New Delhi.
2. Manna, A.K., 2018, *Practical Organic Chemistry, Books and Allied*: India.
3. Vogel, A. I., 1994, *Elementary Practical Organic Chemistry*, The English Language Book Society and Longmans.

Reference Books

1. Gurtu, J. N., Kapoor, R., 1987. *Advanced Experimental Chemistry (Organic),* Sultan Chand, New Delhi.
2. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., Tatchell, A.R.,1987. *Vogel'sTextbook of*

Practical Organic Chemistry (Fifth edition), Pearson, India,
3. Bansal, (1990), *Laboratory Manual of Organic Chemistry*, Second Edition., Wiley Eastern Ltd., New York.
4. Soni, P.L., 2012. *Text book of Organic Chemistry*, (29th Edition). Sultan Chand & Sons Publishing, India.
5. Morrison, R.T., Boyd, R.N., Bhattacharjee, S.K., 2010. *Organic Chemistry*, (7th Edition), Pearson Education, India.

Web Resources

1. https://authors.library.caltech.edu.in
2. https://www.vlab.co.in/broad-area-chemical-sciences
3. https://fac.ksu.edu.sa/sites/default/files/vogel-practicalorganicchemistry_longmans-3rdedrevised-1957_.pdf
4. https://www.vedantu.com/chemistry/preparation-alkyl-halides
5. https://chem.libretexts.org/Bookshelves/Organic_Chemistry

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	2	2	3	2	3	2	2	2	2
CO3	2	2	2	2	2	2	2	3	3	3	3	3	2	2	2
CO4	2	2	2	2	2	2	2	3	3	3	3	3	2	2	2
CO5	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2
TOTAL	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**12**	**14**	**12**	**13**	**12**	**10**	**10**	**10**
AVERAGE	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2.4**	**2.8**	**2.4**	**2.6**	**2.4**	**2**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

SEMESTER III

ELECTIVE COURSE III: CHEMISTRY FOR PHYSICAL SCIENCES – I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233EC1	4	-	-	-	3	4	60	25	75	100

Prerequisites: Structure of atom and bonding

Learning Objectives

1. To know the basics of atomic orbitals, chemical bonds and hybridization
2. To understand the concepts of thermodynamics, phase rule, nuclear chemistry and its applications.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.	**K1**
2	understand the efficiencies and uses of various fuels and fertilizers.	**K2**
3	explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.	**K2**
4	apply various thermodynamic principles, systems and phase rule.	**K3**
5	analyze various methods for the separation of chemical components	**K4**

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

Unit	Contents	No. of Hours
I	**Chemical Bonding and Nuclear Chemistry** Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.	**12**
II	**Industrial Chemistry** Fuels: Fuel gases-Natural gas, water gas, semi water gas, carburetted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.	**12**
III	**Fundamental Concepts in Organic Chemistry** Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric effect - examples. Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.	**12**
IV	**Thermodynamics and Phase Equilibria** Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no	**12**

	derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. Phase Equilibria: Phase rule - definitions. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).	
V	**Analytical Chemistry** Introduction to 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**
TOTAL		**60**

Self - Study	Types of chemical bonding, types of hybridisation, aromaticity, laws of thermodynamics, various types of systems and phase rule

Textbooks

1. Veeraiyan, V., 2015. Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition.
2. ArunBahl, S., Bahl, B.S., 2012. Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition.
3. Bahl, B.S., Tuli, G.D., Bahl, A., 2020. *Essentials of Physical Chemistry*, (24th Edition), S. Chand and Company Limited, India.
4. Soni, P.L., 2012. *Text book of Organic Chemistry*, (29th Edition). Sultan Chand & Sons Publishing, India.

Reference Books

1. Atkins, P., De Paula, J., 2014. *Physical Chemistry*, (10th Edition), Oxford University Press, Oxford.
2. Madan, R.D., 2014. *Modern Inorganic Chemistry*, (13th Edition). Sultan Chand Publishing Limited, India.
3. Lee, J.D., 2005. *Concise Inorganic Chemistry*, (5th Edition), Wiley Blackwell Science, U.S.A
4. Azaroff, L.V., 2017. *Introduction to Solids*, McGraw Hill Education, India.
5. Bryan, J.C., 2023. *Introduction to Nuclear Science*, (4th Edition), CRC Press, U.S.A

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_

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	2	3	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	3
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	3	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	2
TOTAL	**15**	**11**	**13**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**10**	**11**	**11**	**11**
AVERAGE	**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 III

ELECTIVE LAB COURSE III: CHEMISTRY PRACTICAL FOR PHYSICAL SCIENCES - VOLUMETRIC ANALYSIS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233EP1	-	-	2	-	2	2	30	25	75	100

Prerequisites: Types of titrations

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:		
1	understand the principles of titrimetric methods.	**K1**
2	gain knowledge on the usage of standard flask, pipette and burette.	**K2**
3	design, carry out, record and interpret the results of various titrations and apply their skill in the estimation of various compounds.	**K3**
4	analyze the suitable indicators for various titrations	**K4**
5	evaluate the end points of various titrations	**K5**

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

Contents	No. of Hours
VOLUMETRIC ANALYSIS **Acidimetry** 1. Estimation of sulphuric acid using standard oxalic acid. **Alkalimetry** 2. Estimation of sodium hydroxide using standard sodium carbonate. **Permanganometry** 3. Estimation of oxalic acid using standard ferrous sulphate. 4. Estimation of ferrous sulphate using $KMnO_4$. **Dichrometry** 5.Estimation of Ferrous Sulphate using standard dichromate 6. Estimation of Ferrous Ammonium Sulphate using standard dichromate **Complexometry** 7. Estimation of zinc using EDTA. 8. Estimation of magnesium using EDTA.	**30**

Self Study	Normality, Molarity, Molality and Preparation of Standard solution

Textbooks

1. Venkateswaran, V., R. Veeraswamy, A.R. Kulandivelu. 1997. *Basic Principles of Practical Chemistry*,2nd ed.; Sultan Chand &Sons: New Delhi.
2. Thomas, A.O. 1999. *Practical Chemistry for B.Sc Main students.* Scientific book centre, Cannanore.

Reference Books

1. Vogel, A.I. 1990. *A Text Book for Qualitative Inorganic Analysis*. The English Language Book Society and Longmans
2. . Madan, R.D., 2014. *Modern Inorganic Chemistry*, (13th Edition). Sultan Chand Publishing Limited, India.

3. Charlot .G.2007.*Qualitative Inorganic Analysis.*Thomas Press.
4. Berry A.J, 2013. *Qualitative Inorganic Analysis*. Cambridge University Press.
5. Treadwell F.P . 2019. *Analytical Chemistry Qualitative Analysis.*Alpha Edition.

Web Resources

1. http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis
2. https://chemdictionary.org/titration-indicator/
3. https://cuils.cuchd.in/cgi-bin/koha/opac-detail.pl?biblionumber=29190&shelfbrowse_itemnumber=158886
4. https://www.sciencedirect.com/book/9780125033541/chemistry-inorganic-qualitative-analysis-in-the-laboratory
5. https://link.springer.com/book/10.1007/978-1-4899-6383-3

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	2
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	2	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	3
TOTAL	**15**	**12**	**14**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**11**	**10**	**10**	**11**
AVERAGE	**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 III

SKILL ENHANCEMENT COURSE SEC-II: APPLIED CHEMISTRY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233SE1	2	-	-	-	2	2	30	25	75	100

Pre-requisite: Use of chemicals in every day life

Learning Objectives:

1. To transform the acquired theoretical knowledge to industry and vice-versa
2. To familiarize with synthesis of chemicals used in day today life and to develop entrepreneurship skills.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	remember the synthesis of chemicals used in day today life	**K1**
2	understand the effects of adulteration in food	**K2**
3	illustrate the different processes of water softening and estimation of hardness of Water	**K3**
4	analyze the purity of water	**K4**
5	evaluate the composition of blood	**K5**

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

Units	Contents	No. of Hours
I	**Soaps and Detergents** Soaps: Definition- classification-raw materials used in the manufacture of soap manufacture of toilet soap. Detergents: Definition -various types with examples-advantages of detergents over soaps -cleansing action of soap.	6
II	**Chemicals of everyday use** Preparation and uses of the following articles. Tooth powder, tooth paste, writing inks, gum paste, boot polish, talcum powder, chalk crayons, agar battis, phenyl and moth balls.	6
III	**Adulteration in Food** Adulteration of Food Simple methods to find adulteration of milk, food, oils (edible and-mineral) and honey - Food poisoning and its prevention - Antibodies - Food preservation, coloring, flavoring and sweetening agents in catering technology - Carcinogens of food materials.	6
IV	**Water Treatment** Water treatment: hardness of water temporary and permanent hardness, disadvantages of hard water. Estimation of hardness by EDTA method. Water purification process – ion exchange, reverse osmosis, activated charcoal treatment, Desalination, Disinfection – ozone, UV, chlorination, BIS-specification of drinking water.	6
V	**Clinical Chemistry** Composition of blood - blood grouping - identification of blood groups and matching. Determination of glucose in serum, estimation of glucose in urine. Tests for salts in serum and urine. Estimation of cholesterol in serum.	6
	Total	**30**

Self-study	Advantages of detergents over soaps, Preparation and uses of phenyl and moth balls Carcinogens of food materials, Disadvantages of hard water, Blood grouping

Textbooks:

1. Sharma, B. K. 1994. *Industrial Chemistry: Including Chemical Engineering*, Goel Publishing house, Meerut, India.
2. Jain, P. C.. Jain, M. 2015.*Engineering chemistry*, 15th edn, Dhanpat Rai publications.
3. De Man, John M., 1999.*Principles of Food Chemistry*, 3rd edn, Springer.
4. Jaya Shree Gosh, 1992.*Text book of Pharmaceutical Chemistry*: Sultan Chand and Co.S.Chand and Company .Ram Nagar, N.Delhi.

Reference Books:

1. Zalucha, D. J. and Abbey, K. J. 2007. *Kent and Riegel's Handbook of Industrial Chemistry and Biotechnology*. Springer.
2. Shafiur Rahman, M. 2007. *Handbook of Food Preservation*, 2nd edn, CRC Press, Taylor & Francis Group.
3. Ashutoshkar , 2010.*Medicinal Chemistry*, New age International (p) Ltd, publishers.
4. Heaton, C. A. 1996. *An Introduction to Industrial Chemistry*, Springer Science & Business Media.
5. Kuriakose, J. C. Rajaram, J. 2001. *Chemistry in engineering and technology*, Vol. 2,Tata Mcgraw hill: New Delhi.

Web Resources:

1. https://www.udemy.com/course/detergents-course/?couponCode=ST8MT40924
2. https://www.khanacademy.org/partner-content/mit-k12/mit-k12-math-and-engineering/mit-k12-materials/v/what-is-soap
3. https://www.allenoverseas.com/blog/chemistry-in-everyday-life-facts-examples-and-importance/
4. https://www.sciencedirect.com/book/9780125033541/chemistry-inorganic-qualitative-analysis-in-the-laboratory
5. https://atlas-scientific.com/blog/water-analysis-methods/#:~:text=Water%20analysis%20refers%20to%20the,determine%20the%20quality%20of%20water.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

3 – Strong, 2- Medium, 1- Low

SEMESTER III / IV

SKILL ENHANCEMENT COURSE SEC-III: FITNESS FOR WELLBEING

Course Code	L	T	P	S	Credits	Total Hours	Marks		
							CIA	External	Total
UG23CSE1	1	-	1	-	2	30	25	75	100

Pre-requisites: Basic understanding of health and wellness concepts

Learning Objectives

1. To understand the interconnectedness of physical, mental, and social aspects of well-being, and recognize the importance of physical fitness in achieving holistic health.
2. To develop proficiency in mindfulness techniques, yoga practices, nutritional awareness, and personal hygiene practices to promote overall wellness and healthy lifestyle.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	know physical, mental, and social aspects of health	K1
2	understand holistic health and the role of physical fitness.	K2
3	apply mindfulness and yoga for stress management and mental clarity.	K3
4	implement proper personal hygiene practices for cleanliness and disease prevention.	K3
5	evaluate and implement right nutritional choices.	K5

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

Unit	Contents	No. of Hours
I	**Understanding Health and Physical Fitness** Health – definition- holistic concept of well-being encompassing physical, mental, and social aspects. Physical fitness and its components- muscular strength- flexibility, and body composition. Benefits of Physical Activity- its impact on health and well-being.	6
II	**Techniques of Mindfulness** Mind – Mental frequency, analysis of thought, eradication of worries Breathing Exercises – types and its importance Mindfulness –pain management - techniques for practicing mindfulness - mindfulness and daily physical activities.	6
III	**Foundations of Fitness** Stretching techniques to improve flexibility. Yoga-Definition, yoga poses (asanas) for beginners, Sun Salutations (Surya Namaskar), Yoga Nidra – benefits of yoga nidra.	6
IV	**Nutrition and Wellness** Role of nutrition in fitness - macronutrients, micronutrients - mindful eating practices, balanced diet - consequences of overeating. Components of healthy food. Food ethics.	6
V	**Personal Hygiene Practices** Handwashing- techniques, timing, and importance, oral hygiene- brushing, flossing, and dental care, bathing and showering- proper techniques and frequency, hair care- washing, grooming, and maintaining cleanliness, maintaining personal hygiene, dangers of excessive cosmetic use.	6
	Total	30

Self-study	Balance diet and basic excercises

Textbook:

Bojaxa A. Rosy and Virgin Nithya Veena. V. 2024. *Fitness for Wellbeing*.

Reference Books:

1. Arul Raja Selvan S. R, 2022. *Yogasanam and Health Science*. Self publisher.
2. Vision for Wisdom. 2016. *Value Education*. The World Community Service Centre Vethathiri Publications.
3. WCSC – Vision for Wisdom. 2016. *Paper 1: Yoga and Empowerment*. Vazhga Valamudan Offset Printers Pvt Ltd 29, Nachiappa St, Erode.
4. Lachlan Sleigh. 2023. *Stronger Together the Family's Guide to Fitness and Wellbeing*. Self Publisher.
5. William P. Morgan, Stephen E. Goldston. 2013. *Exercise And Mental Health*. Taylor & Francis.

Web Resources:

1. https://www.google.co.in/books/edition/Psychology_of_Health_and_Fitness/1lYOAwAABAJ?hl=en&gbpv=1&dq=fitness+for+wellbeing&printsec=frontcover
2. https://www.google.co.in/books/edition/The_Little_Book_of_Active_Wellbeing/aA6SzgEACAAJ?hl=en
3. https://www.google.co.in/books/edition/Physical_Activity_and_Mental_Health/yu96DwAAQBAJ?hl=en&gbpv=1&dq=fitness+for+wellbeing&printsec=frontcover
4. https://www.google.co.in/books/edition/The_Complete_Manual_of_Fitness_and_Well/pLPAXPLIMv0C?hl=en&gbpv=1&bsq=fitness+for+wellbeing&dq=fitness+for+wellbeing&printsec=frontcover
5. https://www.google.co.in/books/edition/The_Wellness_Code/4QGZtwAACAAJ?hl=en

SEMESTER III

SPECIFIC VALUE-ADDED COURSE: AGROCHEMICALS AND PESTICIDES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233V01	2	-	-	-	1	2	30	25	75	100

Prerequisite: Knowledge about the usage of agrochemicals and pesticides in agriculture.

Learning Objectives:

1. To recognize the role of agrochemicals and pesticides in agriculture
2. To analyse the fertilizers and pesticides used in agriculture

Course Outcomes

On the successful completion of the course, students will be able to:		
1	remember the classifications of agrochemicals and pesticides	**K1**
2	understand the nature and role of fertilizers and pesticides used in agriculture	**K2**
3	apply the agrochemical and pesticide formulations and techniques in agriculture	**K3**
4	analyze the preparation and factors influencing the efficacy of fertilizers and pesticides	**K4**
5	evaluate the applications of agrochemicals and pesticides	**K5**

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

Units	Contents	No. of Hours
I	**Agrochemicals** Introduction - types - role of agrochemicals in agriculture - merits and demerits - effect of agrochemicals on environment - soil - human and animal health - management of agrochemicals for sustainable agriculture.	6
II	**Fertilizers** Introduction - need for fertilizers - classification of fertilizers - natural inorganic and organic fertilizers - artificial fertilizers - nitrogenous fertilizers. Preparation of urea - phosphate - super phosphate - triple super phosphate and NPK fertilizers.	6
III	**Pesticides** Classifications based on chemical nature and target organisms - insecticides - herbicides - fungicides and rodenticides. Selectivity and specificity of pesticides. Factors influencing the efficacy of pesticides - application methods and environmental conditions.	6
IV	**Pesticide Formulations and Application Techniques** Types of pesticide formulations - liquid concentrates – dusts - granules, and aerosols. Factors influencing pesticide formulations. Equipment used in pesticide application – sprayers - dusters and applicators. Safety precautions and regulations for pesticide handling and application.	6
V	**Insecticides and Fungicides** Insecticides - classification - inorganic insecticides - arsenic compounds and mercury compounds. Natural insecticides - nicotine and rotenone. Organic insecticides - gammexane - chlorodane and aldrin. Fungicides - preparation of Bordeaux mixture.	6
	Total	30

Self-study	Role of agrochemicals in agriculture, Classification of fertilizers, Classification of pesticides, Types of pesticide formulations and Classification of insecticides

Textbooks:

1. Rajakumar, G.R., Patil, S.V., 2023. *Agrochemicals Manures Fertilizers and Growth Regulators*, Satish Serial Publishing House, India.
2. Singh, A., Dutta, A., Patanjali, N., Parmar, B.S., 2020. *Basics of Agrochemical Formulations*, Brillion Publishing, India.
3. Roy, N.K., 2023. *Chemistry of Pesticides*, CBS Publishers and Distributors, India.
4. Kumari, R., 2022. *A Beginner's Guide to Pesticide Chemistry*, Prestige Publishers, India.

Reference Books:

1. Waxman, M.F., 2020. *The Agrochemical and Pesticides Safety Handbook*, (1st Edition), CRC Press, New York.
2. Buchel, K.H., 1983. *Chemistry of Pesticides*, John Wiley & Sons, New York.
3. Rakshit, A., Raha, P., Nirmal De., 2023. *Manures, Fertilizers and Pesticides: Theory and Applications*, CBS Publishers and Distributors Pvt. Ltd., India.
4. Paliwal, P.C., Goel, K., Gupta, R.K., 1974. *Insecticides, Pesticides and Argobased Industries*, Small Business Publications, Delhi.
5. Panda, H., 2022. *The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides (Agrochemicals)*, 2nd Edition, Niir Project Consultancy Services, India.

Web Resources:

1. https://www.khanacademy.org/science/ap-college-environmental-science/x0b0e430a38ebd23f:land-and-water-use/x0b0e430a38ebd23f:effects-of-land-and-water-use-i/v/impacts-of-agricultural-practices
2. https://www.youtube.com/watch?v=qLjmTc-mKSQ
3. https://www.youtube.com/watch?v=LItihxFLUrs
4. https://www.youtube.com/watch?v=AAXcFeRRZDk
5. https://www.youtube.com/watch?v=xuSZFRf0EpY

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

3 – Strong, 2- Medium, 1- Low

SEMESTER III

SPECIFIC VALUE-ADDED COURSE: WATER RESOURCES AND MANAGEMENT

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233V02	2	-	-	-	1	2	30	25	75	100

Pre-requisite: Knowledge in Water quality parameters and pollution

Learning Objectives:

1. To realize the importance of quality water in day-to-day life
2. To understand quality standards of water

Course Outcomes

On the successful completion of the course, student will be able to:		
1	remember and recall the different sources of water pollution	**K1**
2	understand the different water treatment and purification techniques	**K2**
3	apply various methods to measure various physico-chemical parameters of water	**K3**
4	analyze the environmental, social, and economic consequences of water management	**K4**
5	determine the hardness of water and other parameters	**K5**

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

Units	Contents	No. of Hours
I	**Water Pollution** Definition-sources of water pollution-types of water pollutants: sewage and domestic wastes, industrial effluents, agricultural discharges, detergents, disease causing agents and radioactive materials. Eutrophication and its effects.	6
II	**Water Quality Parameters** Physical, chemical and biological water quality parameters-water quality standards for drinking water –BIS and WHO. Determination of pH, Total hardness, DO, BOD and COD.	6
III	**Water Purification** Purification of water for drinking purposes: Sedimentation, filtration and disinfection Desalination: reverse osmosis-Purification of water for industrial purposes: water softening permutit process and ion-exchange process.	6
IV	**Waste Water Treatment** Elementary ideas of waste water treatment: pre-treatment-primary treatment-secondary treatment: aerobic and anaerobic processes –tertiary treatment: evaporation adsorption – chemical precipitation.	6
V	**Restoration and Management** Importance of lakes and rivers-stresses on the Indian rivers and their effects –A restoration case study: Ganga Action Plan: objectives implementation and drawbacks. Rain water harvesting –water recycling-The Water Prevention and control of Pollution Act.	6
	Total	30

Textbooks :

1. De, A. K. 2018. *Environmental Chemistry*, 10th edition, Wiley Eastern Ltd., New Delhi.
2.Sharma, B. K 2014. *Environmental Chemistry*, Goel Publishing House, Meerut.
3. Sawyer,C.N., McCarty,P.L. and Parkin,G.F.2003.*Chemistry for Environmental Engineering and Science.* 5th edition, McGraw -Hill Publishers.

Reference books :

1. Trivedy R. K. and Goel P. K. 1984. Chemical and biological methods for water pollution studies, Environmental Publications, Karad, India.
2. BIS, 1991. Specification for drinking water, Bureau of Indian Standards, New Delhi
3. WHO, 1992. *International standards for drinking water*, World Health Organisation, Geneva.
4. Nollet,L.M.L and De Gelder,L.S.P.2013.*Hand book of water Analysis*, 3rd edition, CRC Press.
5. APHA,2017. *Standard Methods for the Examination of Water and waste water*.23rd edition.American Public Health Association.

Web Resources

1. https://www.epa.gov/wqs-tech
2. https://www.cdc.gov/healthywater/drinking/public/water_quality.html
3. https://www.who.int/water_sanitation_health/publications/drinking-water-quality-guidelines-4th-edition/en/
4. https://www.lib.berkeley.edu/
5. https://asuonline.asu.edu/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	2	2	3	3	2	2	3	3	2	2	2	3	3	3
CO2	3	2	1	2	3	2	3	3	3	2	2	2	3	3	3
CO3	3	2	2	2	3	2	3	3	3	3	3	1	2	2	3
CO4	3	2	2	2	3	2	3	3	3	3	3	2	3	2	3
CO5	3	2	3	3	1	2	3	3	3	3	3	3	3	3	3
TOTAL	**15**	**2**	**10**	**10**	**13**	**10**	**14**	**15**	**15**	**13**	**13**	**10**	**14**	**13**	**15**
AVERAGE	**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 III

SPECIFIC VALUE-ADDED COURSE: FOOD ADULTERATION

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233V03	2	-	-	-	1	2	30	25	75	100

Pre-requisite: Knowledge about food adulterants

Learning Objectives:

1. To identify adulterants in different food samples
2. To implement quality control measures in food processing to prevent adulteration.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember the classifications of agrochemicals and pesticides	**K1**
2.	understand the sources and impacts of environmental contaminants	**K2**
3.	apply various methods to detect adulterants in common food items	**K3**
4.	analyze the stability of flavours during food processing and storage	**K4**
5.	evaluate the roles and impacts of food additives	**K5**

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

Units	Contents	No. of Hours
I	**Adulteration** Food Adulteration-Definition – Types- Poisonous substances-Foreign matter- Cheap substitutes- Spoiled parts. Food Additives – Definitions-Classification and Functions- Legitimate uses of Additives in foods-Intentional and Non Intentional additives- Indirect food additives. Difference between Additives and Adulterants-Toxicological evaluation of food additives.	6
II	**Adulteration of Common Foods and Methods of Detection** Methods of detection of adulterants in the following Foods; Milk, Oil, Grain, Sugar, Spices and condiments, Processed food, Fruits and vegetables. Additives and Sweetening agents (at least two methods of detection for each food item).	6
III	**Colours and Flavours** Colours and Flavours (synthetic and natural) Types of flavours, Flavours generated during processing – reaction flavours, Stability of flavours during food processing, flavour emulsions; essential oils and oleoresins.	6
IV	**Impacts of Adulterants** Chemicals generated during food processing - acrylamide, benzene, hydroxymethyl furfural and nitrosamines. Health impacts-Stomach and liver disorders- mutogenic effects-food poisoning-glaucoma-rhenal failure-cardiac-lungs and brain disorders.	6
V	**Food Quality Standards** Food Safety and Standards-FSSA-Authority of India–Rules and Procedures of Local Authorities. Role of voluntary agencies Suchas, Agmark, I.S.I. Private testing laboratories, Quality control laboratories of consumer co-operatives. Consumer education-Consumer's problems rights and responsibilities-Offenses and Penalties-Procedures to complaint-Compensation to victims**.**	6
	Total	**30**

Self-study	Legitimate uses of Additives in foods, Flavour emulsions, polychlorinated biphenyls, Rules and Procedures of Local Authorities.

Textbooks:

1. Belitz, H.D., Grosch, W., and Schieberle, P., 2008. *Food Chemistry*, (3rd Edition), Springer Berlin.
2. Sathe,A.Y., 1999. *A first course in Food Analysis*, New Age International (P) Ltd.
3. Sehgal,S., *A Laboratory Manual of Food Analysis*, Wiley Publishers.

Reference Books:

1. Leo M.L., Nollet, Leo M.L., Nollet., 2004. *Handbook of Food Analysis*, (2nd Edition), CRC Press, New York.
2. Pomeraz, Y., and MeLoari, C.E., 1996. *Food Analysis: Theory and Practice*, CBS publishers and Distributor, New Delhi.
3. Kirk, R.S, and Sawyer, R., 1991. *Pearson's Composition and Analysis of Foods*, Longman Scientific and Technical. (9th Edition), England.
4. Morton, I.D., & Macleod, A.J., 1990. *Food Flavours*. Part A, BC. Elsevier.
5. Branen, A.L., Davidson, P.M, & Salminen, S., 2001. *Food Additives*. (2nd Edition). Marcel Dekker.

Web Resources:

1. https://indianlegalsolution.com/laws-on-food-adulteration/
2. https://www.vnmkv.ac.in/Content/Home/pdf/student-academic/FCN-246.pdf
3. https://www.vedantu.com/biology/food-adulteration
4. https://egyankosh.ac.in/bitstream/123456789/10014/1/Unit%204.pdf
5. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004061923053802Sanjana_Mittal_Adulteration.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	2	2	3	3	2	2	3	3	2	2	2	3	3	3
CO2	3	2	1	2	3	2	3	3	3	2	2	2	3	3	3
CO3	3	2	2	2	3	2	3	3	3	3	3	1	2	2	3
CO4	3	2	2	2	3	2	3	3	3	3	3	2	3	2	3
CO5	3	2	3	3	1	2	3	3	3	3	3	3	3	3	3
TOTAL	**15**	**2**	**10**	**10**	**13**	**10**	**14**	**15**	**15**	**13**	**13**	**10**	**14**	**13**	**15**
AVERAGE	**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 III/V

SELF-LEARNING COURSE: NUTRITIONAL CHEMISTRY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233SL1/ CU235SL1	-	-	-	-	1	-	-	**25**	**75**	**100**

Pre-requisite: Previous knowledge on nutrients

Learning Objectives:

1. To make the students understand the different types of nutrients essential for growth.
2. To have an idea about food poisoning and its prevention.

Course Outcome

On the successful completion of the course, students will be able to:		
1	remember nutrients present in food	**K1**
2	understand and amino acids and proteins	**K2**
3	apply the skills to identify and prevent food poisoning	**K3**
4	analyse minerals, vitamins and enzymes	**K4**
5	evaluate blood sugar and digestion	**K5**

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

Textbooks

Units	Contents
I	**Nutrients:** Discovery of nutrients-total energy need for the human body, energy and nutrient-calorific value of food. **Carbohydrates:** Definition – classification - sources and energy released from sucrose, lactose and maltose, tests for carbohydrates, manufacture of sucrose, function of carbohydrates-digestion and absorption - regulation of blood sugar-important sources-carbohydrate in the diet.
II	**Proteins:** Definition **-** amino acids - classification and function. Classification-sources and function of common proteins viz egg albumin, insulin, casein, collagen, keratin and haemoglobin -tests for proteins - nucleic acids-RNA, DNA (Structure not necessary). **Lipids:** Definition-biological significance-tests for lipids-preservation of egg, milk, meat, fish, fruits and vegetables by physical (temperature control refrigeration) and chemical methods (preservative).
III	**Minerals:** Calcium – sources – deficiency, phosphorus - food sources – functions, iron – sources – deficiency and potassium - functions, deficiency. **Vitamins:** Classification - sources - deficiency diseases. Food poisoning and its prevention, food preservation, colouring, flavouring and sweeting agents in catering technology. Carcinogens in food materials.
IV	**Enzymes:** Introduction, properties, nomenclature and classifications of enzymes. Oxido-reducatases, transferases, hydrolases, lyases, isomeases, ligases. Cofactors and coenzymes. Mechansim of enzyme catalysis, factors affecting enzyme activity, regulation of enzyme activity. Reversible/ competitive inhibitors and irreversible / noncompetitive inhibitors.
V	**Hot beverages** – Tea, coffee and soups. **Tea** - Quality of the ingredients, time of extraction **Coffee**: Methods of preparation-filtration-percolation-instant coffee powder. **Soup**: Clear soup, cream soup, chowder soup and vegetable soup. **Cold beverages**-Lassi-definition-composition-nutritive value. Fresh juices - orange, mosuombi and mango. Synthetic fruit flavoured drinks-carbonated drinks-alcoholic beverages.

Textbooks

1. Swaminathan, M. 1977. Handbook of Food and Nutrition, (1st ed.). Chennai: Ganesh & Co.
2. Satish Gupte, 2003. A text book of Microbiology"' 1st edition, Jaypee Brothers Medical publishers (P) Ltd., New Delhi.

Reference Books

1. S. S. Marwahaand Arora, 2000. Food Processing: Biotechnological Applications, Asiatech publications, New Delhi.
2. Muddambi S.R. and Rajgopal M. V., 1987. *Fundamentals of Food and Nutrition*, Wiley Eastern Ltd., New Delhi.
3. Shubhangini Joshi, 2000. *Textbook of food and nutrition*, Tata Macgro hill Publishing Co., New Delhi.
4. Norman N. Potter 1996. *"Food science*", 5th edition, CBS publishers and Distributors.
5. Branen, A.L., Davidson, P.M, & Salminen, S., 2001. *Food Additives*. (2nd Edition). Marcel Dekker.

Web Resources

1. https://wikieducator.org/Nutritional_Chemistry_and_Biochemistry
2. https://www.vsu.edu/agriculture/agricultural-research-station/food-sciences/food chemistry.php
3. http://www2.tmsc.org/sms/nutrionchem6.pdf.
4. https://www.nestacertified.com/the-chemistry-of-nutrition/
5. https://www.cambridge.org/core/books/cambridge-humandisease/nutritionalchemistry

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

CORE COURSE IV: GENERAL CHEMISTRY - IV

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU234CC1	5	-	-	-	5	5	75	25	75	100

Pre-requisite: General Chemistry III

Learning Objectives:

1. To provide a comprehensive knowledge on thermodynamic concepts and transition elements
2. To know the organic chemistry of ethers, aldehydes, ketones and carboxylic acids

Course Outcomes

On the successful completion of the course, students will be able to:		
1	define the terms in thermodynamics, periodic properties of transition elements and to recognize the properties of aldehydes, ketones and carboxylic acids.	**K1**
2	discuss the fundamentals in the chemistry of ethers, epoxides and carbonyl compounds and to understand the principles behind thermodynamics	**K2**
3	apply the laws of thermodynamics and to synthesise various organic compounds	**K3**
4	classify transition elements into series and to analyse the properties of ethers, acids, epoxides, halogen derivatives and thermodynamical concepts	**K4**
5	determine the thermodynamic relations and to evaluate the oxidation, reduction and other properties of organic compounds	**K5**

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

Units	Contents	No. of Hours
I	**Thermodynamics I** Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson effect- inversion temperature. Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications.	**15**
II	**Thermodynamics II** Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder. Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships. Third law of thermodynamics - Nernst heat theorem; Applications of thirdlaw - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.	**15**

III	**General Characteristics of d-block elements** **Transition Elements**- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups. Extraction and uses of Titanium, Vanadium and Chromium.	**15**
IV	**Ethers and Thio ethers** Ethers-Nomenclature, general methods of preparations, (any two) Zeisel's method of estimation of methoxy group.. Thioethers - nomenclature, structure, preparation and uses. **Aldehydes and Ketones** General methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein – Pondorf Verley reduction, reduction with $LiAlH_4$ and $NaBH_4$.,Addition reactions of unsaturated carbonyl compounds: Michael addition.	**15**
V	**Carboxylic Acids**: Structure, preparation, acidic nature, HVZ reaction, Claisen ester condensation, decarboxylation, Hunsdiecker reaction. **Carboxylic acid Derivatives:** Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Schottan- Baumann reaction, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement. **Halogen substituted acids –** alpha, Beta halogenated substituted acids, Preparation and properties.	**15**
	Total	**75**

Self-study	Nomenclature of acids, ethers, aldehydes and ketones.

Textbooks:

1. Madan, R.D, Sathya Prakash, 2003, *Modern Inorganic Chemistry*, (2^{nd} edition), S.Chand and Company, New Delhi.
2. Soni, P.L, 2000, *Text book of Organic Chemistry*. (20^{th} edition), Sultan Chand Publishers.
3. Puri, Sharma, Kalia, 2021,*Principles of Inorganic Chemistry,* (33^{rd} edition),Vishal Publishers.
4. Puri B.R., Sharma L.R. and Pathania, 2017, *Principles of Physical Chemistry*, (33^{rd} edition) ShobanLal Nagin Chand and Co., Vishal Publishers.
5. Kapoor, K. L., 2009.*A Textbook of Physical chemistry*, volume-2, (3^{rd} edition) Macmillan, India Ltd

Reference Books:

1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry* ,4^{th}ed.; The Macmillan Company: Newyork.
2. Lee, J. D. 1991, *Concise Inorganic Chemistry, (*4^{th} edition) ELBS William Heinemann: London.
3. Gurudeep Raj, 2001, *Advanced Inorganic Chemistry, (*26^{th}edition); Goel Publishing House: Meerut.
4. Atkins, P.W. and Paula, J. 2014, *Physical Chemistry*, (10th edition.); OxfordUniversity Press:New York.

5. Huheey, J. E. 1993, *Inorganic Chemistry: Principles of Structure and Reactivity, (*4th edition) Addison Wesley Publishing Company: India.

Web Resources:

1. https://nptel.ac.in/courses/112102255 Thermodynamics
2. https://nptel.ac.in/courses/104101136
3. http://nptel.ac.in/courses/104101090/Classification of elements and periodic properties
4. http://nptel.ac.in/courses/104101090/
5. 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
CO1	3	1	2	3	3	2	2	3	3	2	2	2	3	3	3
CO2	3	3	1	2	3	2	3	3	3	2	2	2	3	3	3
CO3	3	2	2	2	3	2	3	3	3	3	3	1	2	2	3
CO4	3	2	2	2	3	2	3	3	3	3	3	2	3	2	3
CO5	3	2	3	3	1	2	3	3	3	3	3	3	3	3	3
TOTAL	**15**	**10**	**10**	**10**	**13**	**10**	**14**	**15**	**15**	**13**	**13**	**10**	**14**	**13**	**15**
AVERAGE	**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 IV

CORE LAB COURSE IV: PHYSICAL CHEMISTRY PRACTICAL - I

CONDUCTOMETRIC AND POTENTIOMETRIC TITRATIONS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU234CP1	-	-	3	-	3	3	45	-	75	100

Pre-requisite: General Chemistry – I and II

Learning Objectives:

1. To understand the principle of conductometric and potentiometric titrations
2. To determine the concentration, conductance and dissociation constant of compounds

Course Outcomes

On the successful completion of the course, students will be able to:		
1	remember the theoretical concepts of the experiments	**K1**
2	understand the concepts of conductometric and potentiometric titrations	**K2**
3	apply the principles of conductometry and potentiometry to determine the strength of unknown solutions.	**K3**
4	analyze the strength of unknown solution by potentiometric method	**K4**
5	evaluate the concentration , conductance , dissociation constant of compounds	**K5**

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

Self-study	Theory behind potentiometric and conductometric titrations

Contents	No. of Hours
Conductometric Titrations 1) Comparison of the strengths of given hydrochloric acids using NaOH 2) Estimation of the strength of hydrochloric acid using Std. HCl and NaOH 3) Estimation of strength of weak acid and strong acid using NaOH **Potentiometric Titrations** 4) Determination of the strength of $FeSO_4$ using Std. Ferrous Ammonium Sulphate and link – $K_2Cr_2O_7$ 5) Determination of the strength of Ferrous Ammonium Sulphate using Std.$FeSO_4$ and link $KMnO_4$ 6) Determination of solubility product of a sparingly soluble substance 7) Determination of heat of solution by solubility method (Benzoic acid, Ammonium oxalate) **Demonstration** 8) Determination of heat of hydration of copper sulphate- Demo 9) Determination of concentration of copper sulphate solution – Demo	**45**

Textbooks

1. Viswanathan, B., Raghavan, P.S., 2005. *Practical Physical Chemistry*. Viva Books Ltd, India.
2. Sienko, M.J., Plane, R.A.. Martu, S.T., 1984, *Experimental Chemistry*. International student Edn.

Reference Books

1. Thomas, A. O., 1989. *Practical Chemistry for B.Sc Main students*, Scientific book centre, Cannanore.
2. Shoemaker, D.P., Garland, C.W., Nibler, J.W., 1974. *Experiments in Physical Chemistry*. McGraw-Hill International.
3. Levitt, B.P., 1972. *Findlay's Practical Physical Chemistry*. (Nineth Edition), Longman Group Ltd. New York.
4. Vishwanathan ,B.,Raghavan, P.S.2005. *Practical Physical Chemisry*.M.V.Learning.

5. Yadav, J.B.2016.*Advanced Practical Physical Chemistry*, Krishna Prakashan Media.

Web Resources

1. https://edu.rsc.org/experiments/titrating-sodium-hydroxide-with-hydrochloric-acid/697.article
2. https://egyankosh.ac.in/bitstream/123456789/43276/1/Exp-3.pdf
3. https://heartwarit.files.wordpress.com/2018/03/titration-lab-report.pdf
4. https://nitm.ac.in/ckfinder/userfiles/files/CY%20151_Labmanual%20Chemistry%20B_Tech%201st%20year.pdf
5. https://www.vivabooksindia.com/book/practical-physical-chemistry

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

ELECTIVE COURSE IV: CHEMISTRY FOR PHYSICAL SCIENCES – II

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU234EC1	4	-	-	-	3	4	60	25	75	100

Prerequisites: Chemistry for physical sciences -I

Learning Objectives

1.To know co-ordination Chemistry, Water Technology and catalysis

2.To understand Carbohydrates, Amino acids and electrochemistry

Course Outcomes

On the successful completion of the course, student will be able to:		
1	write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology	**K1**
2	explain the preparation and property of carbohydrate, amino acids and nucleic acids.	**K2**
3	apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.	**K3**
3	determine the reaction rate, order of chemical reaction	**K3**
4	analyze the various type of photochemical process and catalysis.	**K4**
5	evaluate the nature of carbohydrates, reaction rates and electroplating metals	**K5**

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

Unit	Contents	No. of Hours
I	**Co-ordination Chemistry and Water Technology** Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to [Ni(CO)4], [Ni(CN)4]2-,[Co(CN)6]3- Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques- BOD, COD.	**12**
II	**Carbohydrates and Amino acids** Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose –fructose interconversion. Properties of starch and cellulose. Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).	**12**
III	**Electrochemistry** Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.	**12**
IV	**Kinetics and Catalysis** Order and molecularity. Integrated rate expression for I and II (2A Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.	**12**

V	**Photochemistry** Grothus-Draper's law and Stark-Einsteins law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).	**12**
TOTAL		**60**

Self Study	Co-ordination compounds, fundamentals of Carbohydrate, basics of amino acids, rate of reactions, photochemical reactions

Textbooks

1. Veeraiyan, V., 2015. *Text book of Ancillary Chemistry*; High mount publishing house, Chennai, first edition.
2. ArunBahl, S., Bahl, B.S., 2012. *Advanced Organic Chemistry*; S.Chand and Company, New Delhi, twenty third edition.
3. Bahl, B.S., Tuli, G.D., Bahl, A., 2020. *Essentials of Physical Chemistry*, (24th Edition), S. Chand and Company Limited, India.
4. Soni, P.L., 2012. *Text book of Organic Chemistry*, (29th Edition). Sultan Chand & Sons Publishing, India.

Reference Books

1. Atkins, P., De Paula, J., 2014. *Physical Chemistry*, (10th Edition), Oxford University Press, Oxford.
6. Madan, R.D., 2014. *Modern Inorganic Chemistry*, (13th Edition). Sultan Chand Publishing Limited, India.
7. Lee, J.D., 2005. *Concise Inorganic Chemistry*, (5th Edition), Wiley Blackwell Science, U.S.A
8. Azaroff, L.V., 2017. *Introduction to Solids*, McGraw Hill Education, India.
9. Bryan, J.C., 2023. *Introduction to Nuclear Science*, (4th Edition), CRC Press, U.S.A

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_

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

ELECTIVE LAB COURSE IV: CHEMISTRY PRACTICAL FOR PHYSICAL SCIENCES: SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU234EP1	-	-	2	-	2	2	30	25	75	100

Prerequisites:

Students should have knowledge about organic compounds

Learning Objectives

1.To identify organic functional groups

2.To detect 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	**K1**
2	identify the functional group present in the organic compounds	**K2**
3	detect the elements present	**K3**
4	distinguish between aliphatic, aromatic, saturated and unsaturated compounds	**K3**
5	analyze the given organic substance	**K4**

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

Contents	No. of Hours
SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS The analysis must be carried out as follows: a)Functional group tests [phenol, mono carboxylic acids, ester, aldehyde, diamide and carbohydrate]. b) To distinguish between aliphatic and aromatic compounds. c)To distinguish – Saturated and unsaturated compounds. d)Elements present or absent	**30**

Self-study	Saturated and unsaturated compounds

Textbooks

1. Thomas, A.O. 1999. *Practical Chemistry*, 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*, 6th ed.; PearsonEducation Ltd: New Delhi,.

Reference Books

1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R.2002, *Basic Principles ofPractical Chemistry,*2nd ed.; Sultan Chand &Sons:, New Delhi.
2. Thomas, A.O. 1999. Practical Chemistry for B.Sc Main students. Scientific book centre, Cannanore.
3. Mohan Roa Gangula, 2021.*Qualitative Analysis of Organic Compounds.*
4. Gurtu, J. N., Kapoor, R., 1987. *Advanced Experimental Chemistry (Organic),* Sultan Chand, New Delhi
5. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., Tatchell, A.R.,1987. *Vogel'sTextbook of Practical Organic Chemistry* 5thed., Pearson, India,

Web Resources

1. http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis
2. https://chemdictionary.org/titration-indicator/
3. https://www.vlab.co.in/broad-area-chemical-sciences

4. https://fac.ksu.edu.sa/sites/default/files/vogel-practicalorganicchemistry_longmans-
    a. 3rdedrevised-1957_.pdf
5. https://chem.libretexts.org/Bookshelves/Organic_Chemistry

MAPPING WITH PROGRAMME OUTCOMES
AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2
CO2	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2	2	2	2
CO4	3	2	3	2	2	2	2	3	2	2	2	2	2	2	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2	2	2	3
TOTAL	**15**	**12**	**14**	**13**	**13**	**10**	**10**	**15**	**10**	**10**	**10**	**11**	**10**	**10**	**11**
AVERAGE	**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 III / IV

SKILL ENHANCEMENT COURSE SEC IV: DIGITAL FLUENCY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG23CSE2	2	-	-	-	2	2	30	50	50	100

Pre-requisite: Basic computer knowledge

Learning Objectives:

1. To provide a comprehensive suite of productivity tools that enhance efficiency
2. To build essential soft skills that are needed for professional success.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	work with text, themes and styles	**K1**
2.	produce a mail merge	**K2**
3.	secure information in an Excel workbook	**K2**
4.	perform documentation and presentation skills	**K2, K3**
5.	add special effects to slide transitions	**K3**

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

Units	Contents	No. of Hours
I	**Microsoft Word 2010:** Starting Word 2010 - Understanding the Word Program Screen - Giving Commands in Word - Using Command Shortcuts – Document: Creating - Opening - Previewing - Printing and Saving. Getting Started with Documents: Entering and Deleting Text - Navigating through a Document - Viewing a Document. Working with and Editing Text: Spell Check and Grammar Check-Finding and Replacing Text - Inserting Symbols and Special Characters – Copying, Moving, and Pasting Text.	**6**
II	**Formatting Characters and Paragraphs**: Changing Font Type, Font Size, Font Color, Font Styles and Effects, Text Case, Creating Lists, Paragraph Alignment, Paragraph Borders and Shadings, Spacing between Paragraphs and Lines. Formatting the Page: Adjusting Margins, Page Orientation and Size, Columns and Ordering, Headers and Footers, Page Numbering. Working with Shapes, Pictures and SmartArt: Inserting Clip Art, Pictures and Graphics File, Resize Graphics, Removing Picture's Background, Text Boxes, Smart Art, Applying Special Effects. Working with Tables: Create Table, Add and delete Row or Column, Apply Table Style - Working with Mailings.	**6**
III	**Microsoft Excel 2010:** Creating Workbooks and Entering Data: Creating and Saving a New Workbook - Navigating the Excel Interface, Worksheets, and Workbooks - Entering Data in Worksheets - Inserting, Deleting, and Rearranging Worksheets. Formatting Worksheets: Inserting and Deleting Rows, Columns and Cells - Formatting Cells and Ranges - Printing your Excel Worksheets and Workbooks. Crunching Numbers with Formulas and Functions: Difference between Formulae and Functions - Applying Functions. Creating Powerful and Persuasive Charts: Creating, Laying Out, and Formatting a Chart.	**6**
IV	**Microsoft PowerPoint 2010:** Creating a Presentation - Changing the Slide Size and Orientation - Navigating the PowerPoint Window - Add content to a Slide - Adding, Deleting, and Rearranging Slides - Using views to work on Presentation. Creating Clear and Compelling Slides: Planning the Slides in Presentation - Choosing Slide Layouts to Suit the Contents - Adding Tables, SmartArt, Charts, Pictures, Movies, Sounds, Transitions and Animations - Slideshow.	**6**

V	**Digital Platforms:** Graphic Design Platform: Canva - Logo Making, Invitation Designing. E-learning Platform: Virtual Meet – Technical Requirements, Scheduling Meetings, Sharing Presentations, Recording the Meetings. Online Forms: Creating Questionnaire, Publishing Questionnaire, Analyzing the Responses, Downloading the Response to Spreadsheet.	**6**
	Total	**30**

Self-study	Parts of a computer and their functions

Textbook:

Anto Hepzie Bai J. & Divya Merry Malar J.,2024, Digital Fluency, Nanjil Publications, Nagercoil.

Reference Books:

1. Steve Schwartz, 2017, *Microsoft Office 2010 for Windows,* Peachpit Press.
2. Ramesh Bangia, 2015, Learning Microsoft Office 2010, Khanna Book Publishing Company.
3. Bittu Kumar, 2018, *Mastering MS Office*, V & S Publishers.
4. James Bernstein, 2020, *Google Meet Made Easy*, e-book, Amazon.
5. Zeldman, Jeffrey, 2005, *Web Standards Design Guide*, Charles River Media.

Web Resources:

1. https://www.youtube.com/watch?v=oocieLn6umo
2. https://www.youtube.com/watch?v=pPSwbK4_GdY
3. https://www.youtube.com/watch?v=DKAiSDhU4To
4. https://www.youtube.com/watch?v=sbeyPahs-ng
5. https://www.youtube.com/watch?v=fACEzzmXelY

SEMESTER IV

ENVIRONMENTAL STUDIES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG234EV1	2	-	-	-	2	2	30	25	75	100

Pre-requisite: Interest to learn about nature and surrounding.

Learning Objectives

1.To know the different types of pollutions, causes and effects

2.To understand the importance of ecosystem, resources and waste management

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	know the different kinds of resources, pollution and ecosystems	K1
2.	understand the biodiversity and its constituents	K2
3.	use the methods to control pollution and, to conserve the resources and ecosystem	K3
4.	analyse the factors behind pollution, global warming and health effects for sustainable development	K4
5.	evaluate various water, disaster and waste management systems	K5

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

Units	Contents	No. of Hours
I	**Nature of Environmental Studies** Multidisciplinary nature of environmental studies- scope of environmental studies - environmental ethics-importance- types- natural resources - renewable and non-renewable resources – forest, land, water and energy resources.	6
II	**Biodiversity and its Conservation** Definition: genetic, species of biodiversity - biodiversity hot-spots in India - endangered and endemic species of India – Red Data Book - In-situ and Ex-situ conservation of biodiversity. Ecosystem- types - structure and function - food chain - food web- ecological pyramids- forest and pond ecosystems.	6
III	**Environmental Pollution** Pollution - causes, types and control measures of air, water, soil and noise pollution. Role of an individual in prevention of pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Disaster management– cyclone, flood, drought and earthquake.	6
IV	**Environmental Management and Sustainable Development** From unsustainable to sustainable development -Environmental Law and Policy – Objectives; The Water and Air Acts-The Environment Protection Act - Environmental Auditing-Environmental Impact Assessment-Life Cycle Assessment- Human Health Risk Assessment, Water conservation, rain water harvesting, watershed management.	6
V	**Social Issues and the Environment** Population explosion-impact of population growth on environment and social environment. Women and Child Welfare, Role of information technology in environment and human health. Consumerism and waste products. Climate change - global warming, acid rain and ozone layer depletion. **Field work:** Address environmental concerns in the campus (or) Document environmental assets- river / forest / grassland / hill / mountain in the locality (or) Study a local polluted site-urban / rural / industrial / agricultural area.	6
	Total	30

Self-study	Pollutants, Ecosystems and Resources

Textbook

Punitha A and Gladis Latha R, 2024. Fundamentals of Environmental Science.

Reference Books

1. Agarwal, K.C., 2001. *Environmental Biology*, Nidi Publishers. Ltd. Bikaner.
2. Brunner R.C., 1989, *Hazardous Waste Incineration*, McGraw Hill Ltd.
3. Gorhani, E & Hepworth, M.T. 2001. *Environmental Encyclopedia*, Jaico Publ. House, Mumbai.
4. De A.K.,2018. *Environmental Chemistry*, Wiley Eastern Ltd.
5. Gleick, H.P. 1993. *Water in crisis*, Pacific Institute for Studies Oxford Univ. Press.

Web Resources

1.https://www.sciencenews.org/topic/environment
2.https://news.mongabay.com/2024/05/
3. https://www.sciencedaily.com/news/earth_climate/environmental_issues/
4.https://wildlife.org/rising-oryx-numbers-may-distress-new-mexico-ecosystem/
5. https://phys.org/news/2024-02-global-wild-megafauna-ecosystem-properties.html

SEMESTER III & IV
LIFE SKILL TRAINING II: CATECHISM

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG234LC1	1	-	-	-	1	1	15	50	50	100

Learning Objectives:

1. To develop human values through value education
2. To understand the importance of personal development to lead a moral life

Course Outcomes

On the successful completion of the course, student will be able to:		
1	know and understand the aim and importance of value education	K1,K2
2	get rid of inferiority complex and act confidently in the society	K3
3	live lovingly by facing loneliness and make decisions on their own	K3
4	develop human dignity and able to stand bravely in adversity	K6
5	learn unity in diversity and grow in a life of grace	K6

K1 - Remember **K2**-Understand; **K3**-Apply; **K6**- Create

Units	Contents	No. of Hours
I	**Face Loneliness:** Loneliness – Causes for Loneliness – Loneliness in Jesus Christ Life – Ways to Overcome Loneliness – Need and Importance Bible Reference: Matthew: 6:5-6	3
II	**Inferiority Complex:** Inferiority Complex - Types – Ways to Get Rid of Inferiority Complex – Words of Eric Menthol – Balanced Emotion – Jesus and his Disciples. Bible Reference: Luke 8:43-48	3
III	**Decision Making:** Importance of Decision Making – Different Steps – Search – Think – Pray – Decide- Jesus and his Decisions Bible Reference: Mathew 7:7-8 **Independent:** Freedom from Control – Different Types of Freedom - Jesus the Liberator Bible Reference: Mark 10:46-52	3
IV	**Human Dignity:** Basic Needs – Factors that Degrade Human Dignity – How to Develop Human Dignity. Bible Reference: Luke 6:20-26 **Stand Bravely in Adversity:** Views of Abraham Maslow – Jesus and his Adversity. Bible Reference: Luke 22:43	3
V	**Unity in Diversity:** Need for Unity – The Second Vatican Council on the Mission of Christian Unity. Bible Reference: I Corinthians 1:10 **To Grow in a Life of Grace:** Graceful Life – View of Holy Bible – Moses – Amos – Paul – Graceful Life of Jesus Bible Reference: Amos 5:4	3
TOTAL		15

Textbooks

Valvukku Valikattuvom, Christian Life Committee, Kottar Diocese
The Holy Bible

SEMESTER III & IV

LIFE SKILL TRAINING II: MORAL

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG234LM1	1	-	-	-	1	1	15	50	50	100

Learning Objectives:

1. To cultivate human values through value education
2. To comprehend the importance of humane and morals to lead ethical and moral life.

Course Outcome

On the successful completion of the course, student will be able to:		
1	know the significance of life	**K1**
2	understand the importance of self-care	**K2**
3	realise the duty of youngsters in the society and live up to it	**K3**
4	analyse how to achieve success in profession	**K4**
5	develop mystical values by inculcating good thoughts	**K5**

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

Unit	Contents	No. of Hours
I	**Edu Care:** Introduction- -Personal Care-Temple of Mind-Emotional stability-Inner views- Internal and external Beauty- Life is a Celebration	**3**
II	**Self-care:** Self- discipline- Selfishness in doing good things- Adolescence stage-What am I? - Self-esteem- Self-Confidence- Respect for womanhood	**3**
III	**Profession based Values:** Time Management-Continuous effort- What next? –Present moment is yours, Hard work and Smart Work-Broad view- destruct your failures	**3**
IV	**Mystical Values:** Thoughts- Positive and negative thoughts- Origin of negative thoughts-Moralisation of needs- Elimination of obstacles	**3**
V	**Society and you:** Knowing Humanity-Thankfulness- love and happiness- Honesty-Heroism -Youth is gift of God-Youngsters in politics and social media utilization.	**3**
TOTAL		**15**

Textbook

"Munaetrathin Mugavari", G. Chandran, Vaigarai Publisher.

SEMESTER IV/VI

SELF-LEARNING COURSE: CHEMISTRY OF FUELS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU234SL1/ CU236SL1	-	-	-	-	1	-	-	**25**	**75**	**100**

Pre-requisite: Students should have basic knowledge on fuels

Learning Objectives:

1. To distinguish conventional petroleum-based fuels and alternative & renewable fuels.
2. To gain the knowledge of the origin of petroleum, crude oil and different refining processes.

Course Outcome

On the successful completion of the course, students will be able to:		
1	remember the classifications of coals and lubricants	**K1**
2	understand the properties and definitions of solid, liquid, and gaseous fuels	**K2**
3	apply the skills to optimize fuel processing techniques	**K3**
4	analyze and compare renewable and non-renewable energy sources	**K4**
5	evaluate the applications of fuels in various industries	**K5**

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

Units	Contents
I	**History of Fuels** Review of energy sources (renewable and non-renewable). History of solid, liquid and gaseous fuels, Definitions and properties of solid fuels, Definitions and properties of liquid and gaseous fuels, Production and Consumption pattern of fuels. Calorific value - Gross calorific value and Net calorific value, Determination of calorific value -Bomb calorimeter and Dulong's Method.
II	**Gaseous fuels:** Qualitative treatment of non-petroleum fuels -Natural gas, Synthetic gases- their composition & properties. Producer gas, Water gas, Coal Gas, LPG, CNG, and Hydrogen as fuel.
III	**Petroleum** Composition of crude petroleum, Different types of petroleum products and their applications. Principle and process of fractional distillation, Cracking - Thermal and catalytic cracking
IV	**Coal** Coal classification, Coal mining, Coal preparation and washing, Combustion of coal and coke making, Action of heat on different coal samples, Different types of coal combustion techniques, Coal tar distillation, Coal liquefaction, Direct liquefaction, Indirect liquefaction, Coal gasification(Hydro gasification and Catalytic gasification), Uses of coal (fuel and nonfuel) in various industries
V	**Lubricants** Classification of lubricants, lubricating oils (conducting and non-conducting), Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants – viscosity index, cloud point, pore point.

Textbooks

1. Uttam Ray Chaudhuri., 2010. *Fundamentals of Petroleum and Petrochemical Engineering*, Satish Serial Publishing House, India.
2. Sharma,B.K., 2000. *Industrial Chemistry*, Goel Publishing House, Meerut.
3. Jain,P.C., Jain,M., 1988. *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.

Reference Books:

1. Richard, A., Dave, I.P., 2000. *Modern Petroleum Technology*,Vol 1,6th edition.

2. Alan, G., Lucas, I.P., 2000. *Modern Petroleum Technology*. Vol 2, Downstream,Ed., 6th ed., John Wiley & Sons. Ltd.
3. Bhaskar Rao,B.K., 2003. *Modern Petroleum Refining Processes*, 4th ed., Oxford & IBH Publishing Co.Pvt. Ltd.
4. John Griswold.,2006. Fuels *Combustion and Furnaces*, Mc-Graw Hill Book Company, New York
5. Nelson, W, L., *Petroleum Refinery Engineering*, 4th ed. Mc-Graw Hill Book Company, New York

Web Resources:

1. https://www.aiche.org/sites/default/files/community/262801/aiche-community-site-event/514546/petroleumrefining-aiche-rbt11-15-19.pdf
2. https://www.fkit.unizg.hr/_download/repository/PRPP_2013_Refinig_intro_H2_tech.pdf
3. https://tameson.com/pages/lubricants
4. https://www.wbdg.org/ffc/dod/cpc-source/petroleum-oil-lubricants-storage-distribution-systems-knowledge-area
5. https://combustion.in/en_US/standard-gaseous-fuels-high-calorific-value-gas-fuels/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

3 – Strong, 2- Medium, 1- Low