AVS

COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS)

Attur Main Road, Ramalingapuram, Salem - 106.

(Recognized under section 2(f) & 12(B) of UGC Act 1956 and

Accredited by NAAC with 'A' Grade)

(Co - Educational Institution | Affiliated to Periyar University, Salem

ISO 9001 : 2015 Certified Institution)

principal@avscollege.ac.in | www.avscollege.ac.in

Ph : 98426 29322, 94427 00205.

Syllabus for

B. Sc CHEMISTRY

CHOICE BASED CREDIT SYSTEM –

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK

(CBCS – LOCF)

(Applicable to the Candidates admitted from 2023-24 onwards)

VISION

- To attain excellence in the field of education by creating competent scholars with a touch of human values.

MISSION

- To accomplish eminence in the academic domain.
- To provide updated infrastructure.
- To educate value based education.
- To impart skills through efficient training programs.
- To cultivate culture and tradition with discipline and determination.

REGULATIONS

1. Eligibility for Admission:

A candidate who has passed the Higher Secondary Examination of Tamil Nadu Higher Secondary Board or an examination of some other board accepted by the syndicate as equivalent there with Chemistry and Physics and any one of the following subjects namely Maths, Botany, Zoology or Biology shall be eligible for admission into B.Sc., course in Chemistry

2. Duration:

The course for the degree of Bachelor of Science shall consist of three academic years divided into six semesters

3. Eligibility for award of degree:

The degree of Bachelors' in Science will be awarded to any student who has completed the appropriate programme of study and passed examinations as a student at the College in accordance with such other Regulations for Students of the College as may be applicable.

4. Course of Study:

The course of study for the B.Sc., degree in the Chemistry shall comprise of the following subjects according to the syllabus and books prescribed from time to time. The Syllabus for. various subjects shall be demarcated into five units in each subject

Part – II– English, Elective Courses, Project with viva voce

Part – IV–Foundation course, Skill Enhancement courses (Non-Major Elective),

Skill Enhancement courses (Discipline Specific), Skill Enhancement courses

Environmental Studies, Value Education, Internship, Professional Competency Skill

Part – V–Extension Activity, NSS / NCC / Sports / YRC and other co and extracurricular activities offered under part – V of the programmes

5. Scheme of Examination:

There shall be six examinations - two in the first year, two in the second year and two in the third year. Candidates failing in any subject / subjects will be permitted to appear for such failed subject / subjects at subsequent examinations. The syllabus has been divided into six semesters. Examinations (theory and practical) for I, III and V semesters will be held in November / December and Examinations (theory and practical) for II, IV and VI semesters will be held in April / May.

6. Passing Rules:

i) Theory

A candidate who secures not less than 40% in the end semester (external) examination and 40%

marks in the internal examination and continuous internal assessment put together in any course of Part I, II, III & IV shall be declared to have passed the examination in the subject (theory or practical).

ii) Practical

For practical, the minimum for a pass includes the record note book marks also. There is no passing minimum for the record note book. However, submission of a record note book is a. Must

Programme Outcomes (POs)	
On successful completion of the B. Sc Chemistry	
PO1	Understand the chemistry and apply their knowledge in day-to-day life
PO2	Explore the knowledge of analytical techniques to the industries for various analysis
PO3	Develop skills to carryout experiments in various fields of chemistry
PO4	Identify, formulate and solve the technological problems of the industry
PO5	Apply their theoretical knowledge to make the common people to understand the chemistry behind every chemical changes.
PO6	Confidence with skills and techniques necessary to succeed in the competitive examinations.
PO7	Have the knowledge of science principles to practical situations in their respective professional career.
PO8	Acquire the knowledge on the role of chemistry in industries and to become entrepreneur.
PO9	Acquires the ability to synthesis, separate and characterize compounds using laboratory and instrumentation techniques.
PO10	To enhance professional skills in chemistry by providing hands on training to Operate the sophisticated instruments.
PO11	To equip students to meet current industrial need .
PO12	To equip students with different types of problem solving related to academic and industrial domain.

Program Specific Outcomes (PSOs)	
On successful completion of Bachelor of Chemistry programme, the student should be able to:	
PSO1	Apply chemistry knowledge to solve the problems in various areas.
PSO2	Acquire a skill for safe handling of chemicals, apparatus and instruments
PSO3	Identify and analyze problems and gain skills to interpret chemical information
PSO4	Gain practical knowledge and analytical skills in designing and carrying out chemical experiments
PSO5	Have enough chemistry knowledge to go for higher studies and become entrepreneur

Programme Educational Objectives (PEOs) The B. Sc Chemistry programme describes accomplishments that graduates are expected to attain within five to seven years after graduation.	
PEO1	To provide, value based and ethical leadership in the professional and social life.
PEO2	To provide the professional consultancy and research support for the relevant organization in the domain of super specialization.
PEO3	To provide skills of observations and drawing logical inferences from the scientific experiments.
PEO4	To gain knowledge of chemistry, physics and mathematics through theory and practical's.
PEO5	To be successful study in higher education in Chemistry.

CREDIT DISTRIBUTION FOR 3 YEARS B. Sc CHEMISTRY PROGRAMME

Part	Course Type	Credits per Course	No. of Papers	Total Credits
Part I	Language – I (Tamil/Hindi/French)	3	4	12
Part II	Language – II (English)	3	4	12
Part III	Core Courses- Theory	5	4	20
	Core Courses- Theory	4	3	12
	Core Courses- Theory	3	3	9
	Core Courses- Practical	3	5	15
	Core Courses- Practical	2	1	2
	Core Courses- Project with viva-voce	2	1	2
	Major Elective Courses- Theory	3	4	12
	Generic Discipline Specific/ Allied Courses - Theory	4	2	8
	Generic Discipline Specific/ Allied Courses - Theory	3	2	6
	Generic Discipline Specific/ Allied Courses - Practical	2	3	6
			Total	**92**
Part IV	Non Major Elective Courses	2	2	4
	Skill Enhancement Courses	2	5	10
	Skill Enhancement Courses	1	1	1
	Professional Competency Skill Enhancement Course	2	1	2
	EVS (Environmental Studies)	2	1	2
	Value Education	2	1	2
	Internship	2	1	2
	MOOC/ SWAYAM/ NPTEL Courses	2	1	2
			Total	**25**
Part V	Extension Activity (NSS/NCC/Physical Education)	1	1	1
			Total Credits	**142**

CONSOLIDATED SEMESTER WISE AND COMPONENT WISE CREDIT DISTRIBUTION FOR 3 YEARS B. Sc CHEMISTRY PROGRAMME

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	**3**	**3**	**3**	**3**	**-**	**-**	**12**
Part II	**3**	**3**	**3**	**3**	**-**	**-**	**12**
Part III	**12**	**14**	**13**	**13**	**22**	**18**	**92**
Part IV	**4**	**4**	**3**	**6**	**4**	**4**	**25**
Part V	**-**	**-**	**-**	**-**	**-**	**1**	**1**
Part VI	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Total	**22**	**24**	**22**	**25**	**26**	**23**	**142**

*Part I, II and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components IV, V, VI have to be completed during the duration of the programme as per the norms, to be eligible to obtain the UG degree.

METHOD OF EVALUATION

Evaluation	Components		Marks
Internal Evaluation	Continuous Internal Assessment Test	15	25 Marks
	Assignments	3	
	Class Participation	2	
	Distribution of marks for Attendance (in percentage) 96 – 100: 5 Marks 91 – 95: 4 Marks 86 – 90: 3 Marks 81 – 85: 2 Marks	5	
External Evaluation	End Semester Examination		75 Marks
Total			**100 Marks**

Note: UG Programmes- A candidate must score minimum 10 marks in Internal and 30 marks in External Evaluation.

CONTINUOUS INTERNAL ASSESSMENT

Categorizing Outcome Assessment Levels Using Bloom's Taxonomy

level	Cognitive Domain	Description
K1	Remember	It is the ability to remember the previously learned concepts or ideas.
K2	Understand	The learner explains concepts or ideas.
K3	Apply	The learner uses existing knowledge in new contexts.
K4	Analyze	The learner is expected to draw relations among ideas and to compare and contrast.
K5	Evaluate	The learner makes judgments based on sound analysis.
K6	Create	The learner creates something unique or original.

Question Paper Blue Print for Continuous Internal Assessment- I& II

Duration: 2 Hours							Maximum: 50 marks
Section	K level						Marks
	K1	K2	K3	K4	K5	K6	
A (no choice)	10						10 X 1 =10
B (no choice)		1	1				2 X 5 =10
C (either or choice)				3			3 x 10 = 30
Total							50 marks

Note: *K4 and K5 levels will be assessed in the Model Examination whereas K5 and K6 Levels will be assessed in the End Semester Examinations.*

Question Paper Blue Print for Continuous Internal Assessment- I

Time: 2 Hours Total Marks: 50 Marks Minimum Pass: 20 Marks

Unit	Section - A	Section - B	Section - C
I	Q.N. 1, 2, 3, 4, 5	Q.N. 11	Q.N. 13 A, 13 B
I or II	-	-	Q.N. 14 A, 14 B
II	Q.N. 6, 7, 8, 9, 10	Q.N. 12	Q.N. 15 A, 15 B

SECTION – A (10 X 1 = 10 Marks)

ANSWER ALL THE QUESTIONS

SECTION – B (2 X 5 = 10 Marks)

ANSWER ALL THE QUESTIONS

SECTION – C (3 X 10 = 30 Marks)

ANSWER ALL THE QUESTIONS (Either or Choice)

Question Paper Blue Print for Continuous Internal Assessment- II

Time: 2 Hours Total Marks: 50 Marks Minimum Pass: 20 Marks

Unit	Section - A	Section - B	Section - C
III	Q.N. 1, 2, 3, 4, 5	Q.N. 11	Q.N. 13 A, 13 B
III or IV	-	-	Q.N. 14 A, 14 B
IV	Q.N. 6, 7, 8, 9, 10	Q.N. 12	Q.N. 15 A, 15 B

SECTION – A (10 X 1 = 10 Marks)

ANSWER ALL THE QUESTIONS

SECTION – B (2 X 5 = 10 Marks)

ANSWER ALL THE QUESTIONS

SECTION – C (3 X 10 = 30 Marks)

ANSWER ALL THE QUESTIONS (Either or Choice)

Question Paper Blue Print for Model Examination & End Semester Examination

Duration: 3 Hours								Maximum: 75 marks
Section		K level						Marks
		K1	K2	K3	K4	K5	K6	
A (no choice, three questions from each unit)		15						15 X 1 =15
B (choice, one question from each unit)			1	1				2 X 5 =10
C (either or choice& two questions from each unit)	*Courses with K4 as the highest cognitive level*				4	1		5 x 10 = 50
	Course with K5 as the highest cognitive level wherein three K4 questions and two K5 questions are compulsory.				3	2		
	Course with K6 as the highest cognitive level wherein two questions each on K4, K5 and one question on K6 are compulsory.				2	2	1	
Total								75 marks

Question Paper Blue Print for Model Examination & End Semester Examination

Time: 2 Hours Total Marks: 75 Marks Minimum Pass: 30 Marks

Unit	Section - A	Section - B	Section - C
I	Q.N. 1, 2, 3	Q.N. 16	Q.N. 21 A, 21 B
II	Q.N. 4, 5, 6	Q.N. 17	Q.N. 22 A, 22 B
III	Q.N. 7, 8, 9	Q.N. 18	Q.N. 23 A, 23 B
IV	Q.N. 10, 11, 12	Q.N. 19	Q.N. 24 A, 24 B
V	Q.N. 13, 14, 15	Q.N. 20	Q.N. 25 A, 25 B

SECTION – A (15 X 1 = 15 Marks)

ANSWER ALL THE QUESTIONS

SECTION – B (2 X 5 = 10 Marks)

ANSWER ANY TWO QUESTIONS

SECTION – C (5 X 10 = 50 Marks)

ANSWER ALL THE QUESTIONS (Either or Choice)

Question Paper Blue Print for Model Practical Examination & End Semester Examination (Practical)

Time: 3 Hours Total Marks: 60 Marks Minimum Pass: 24 Marks

Practical Marks	Maximum Mark	Minimum Mark
Internal	40	16
External	60	24
Total	100	40

Evaluation for End Semester Examinations (Practical)

Record	10 marks
Formula with expansion	05 marks
Observation with data	20 marks
Viva-voce	05 marks
Calculation	15 marks
Result with units	05 marks
TOTAL	**60 MARKS**

*Submission of record with due certification is a must for external practical examinations.

**A student should complete all requires experiments to get 10 marks for the record.

Scheme of Examination for B. Sc Chemistry

First Year – Semester-I

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UFTA01	Podhu Tamil - I	3	3	25	75	100
II	23UFEN01	General English - I	3	3	25	75	100
III	23UCHCC01	Core Course I - General Chemistry - I	9	5	25	75	100
III	23UCHCCP01	Core Course Practical I - Quantitative Inorganic Estimations (Titrimetry) and Inorganic Preparations	3	3	40	60	100
III	23UMAAT01	Allied Mathematics I - Algebra and Calculus	4	4	25	75	100
IV	23UCHFC01	Foundation Course in Chemistry	2	2	25	75	100
IV	23UTANE01	Non Major Elective Course - Pechukalai Thiran	1	2	25	75	100
Total			**25**	**22**	**190**	**510**	**700**

First Year – Semester-II

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UFTA02	Podhu Tamil - II	3	3	25	75	100
II	23UFEN02	General English - II	3	3	25	75	100
III	23UCHCC02	Core Course II - General Chemistry - II	6	5	25	75	100
III	23UCHCCP02	Core Course Practical II - Qualitative Organic Analysis and Preparation of Organic Compounds	3	3	40	60	100
III	23UMAAT02	Allied Mathematics II – Differential Equations and Laplace	4	4	25	75	100
III	23UMAAP01	Allied Mathematics Practical	2	2	40	60	100
IV	23UCHSE01	Skill Enhancement Course I – Cosmetics and Personal Care Products	2	2	25	75	100
IV	23UCSNE07	Non Major Elective Course – Office Automation	2	2	25	75	100
Total			**25**	**24**	**230**	**570**	**800**

Second Year – Semester- III

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UFTA03	Podhu Tamil - III	3	3	25	75	100
II	23UFEN03	General English - III	3	3	25	75	100
III	23UCHCC03	Core Course III - General Chemistry - III	8	5	25	75	100
III	23UCHCCP03	Core Course Practical III - Qualitative Inorganic Analysis	3	3	40	60	100
III	23UPHA01	Elective Course III - Allied Physics-I	3	3	25	75	100
III	23UPHAP01	Elective Course Practical - II Allied Physics Practical-I	2	2	40	60	100
IV	23UCHSE02	Skill Enhancement Course II - Entrepreneurial skills in Chemistry	1	1	100	-	100
IV	23UCHSE03	Skill Enhancement Course III - Pesticide Chemistry	2	2	25	75	100
Total			**25**	**22**	**305**	**495**	**800**

*Skill Enhancement Course SEC-4: Internal Examination Only

Second Year – Semester-IV

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UFTA04	Podhu Tamil - IV	3	3	25	75	100
II	23UFEN04	General English - IV	3	3	25	75	100
I	23UCHCC04	Core Course IV - General Chemistry -IV	6	5	25	75	100
II	23UCHCCP04	Core Course Practical IV- Physical Chemistry Practical-I	3	3	40	60	100
III	23UPHA02	Elective Course IV – Allied Physics-II	3	3	25	75	100
III	23UPHAP02	Elective Course Practical III – Allied Physics Practical-II	2	2	40	60	100
III	23UCHSE04	Skill Enhancement Course IV - Instrumental Methods of Chemical Analysis	2	2	25	75	100
IV	23UCHSE05	Skill Enhancement Course V - Forensic Science	2	2	25	75	100
IV		EVS Environmental Studies	1	2	25	75	100
Total			**25**	**25**	**255**	**645**	**900**

Third Year – Semester -V

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UCHCC05	Core Course V - Organic Chemistry-I	4	4	25	75	100
II	23UCHCC06	Core Course VI - Inorganic Chemistry-I	4	4	25	75	100
III	23UCHCC07	Core Course VII - Physical Chemistry-I	4	4	25	75	100
III	23UCHEC05	Elective Course V - Biochemistry	3	3	25	75	100
III	23UCHEC06	Elective Course VI - Industrial Chemistry	3	3	25	75	100
III	23UCHCCP05	Core Course Practical VII- Physical Chemistry Practical-II	3	2	40	60	100
III	23UCHCCPV01	Core Course Project with viva-voce	2	2	25	75	100
IV		Value Education	2	2	25	75	100
IV	23UCHSI01	Internship	-	2	25	75	100
Total			**25**	**26**	**240**	**660**	**900**

* Internship (Carried out in II year summer vacation-2 weeks) (3-5 members, not exceeding 5 members per group)

Third Year – Semester-VI

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UCHCC08	Core Course VIII - Organic Chemistry-II	4	3	25	75	100
II	23UCHCC09	Core Course IX - Inorganic Chemistry-II	4	3	25	75	100
III	23UCHCC10	Core Course X - Physical Chemistry-II	4	3	25	75	100
III	23UCHCCP06	Core Course Practical VI - Gravimetric Estimation Practical	4	3	40	60	100
III	23UCHEC07	Elective Course VII - Fundamentals of Spectroscopy	4	3	25	75	100
III	23UCHEC08	Elective Course VIII – Nano science	3	3	25	75	100
IV	23UCHPC01	Professional Competency Skill	2	2	25	75	100
IV		MOOC/ SWAYAM/ NPTEL Courses	-	2	-	-	-
V	23UEX01	Extension Activity (Outside College hours)	-	1	-	-	-
Total			**25**	**23**	**190**	**510**	**700**

**Ins. Hrs – Instructional Hours, CIA- Continuous Internal Assessment, ESE- End Semester Examination

Semester: I	Course Code: 23UCHCC01	Hours/Week: 5+4+0	Credit: 5
COURSE TITLE : CORE COURSE I - GENERAL CHEMISTRY - I			

Course Overview:

1. This course covers the atomic structure and periodic trends.
2. These courses generally provide the fundamental of quantum mechanics.
3. In this course covers the modern periodic.
4. This course introduces the basic concepts in organic chemistry and electronic effects.

Learning Objectives:

1. To understand the various atomic models and atomic structure.
2. To familiarizing the wave particle duality of matter properties of s and p-block elements.
3. To discuss the periodic table, periodicity in properties and its application in explaining the chemical behavior.
4. To give the knowledge in nature of chemical bonding.
5. To outline the fundamental concepts of organic chemistry.

Unit - I	Atomic structure and Periodic trends	12 Hours

Model 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 - Hand's rule, Pauli' exclusion principle and Aufbau principle; Numerical problems involving the core concepts.

Unit - II	Introduction to Quantum mechanics and Modern Periodic Table	12 Hours

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 wave functions, formulation of Schrodinger wave equation (derivation not needed) - Probability and electron density-visualizing the orbital's-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, electro negativity-electro negativity scales, applications of electro negativity. Problems involving the core

concepts.

Unit - III	Structure and bonding - I	12 Hours

Ionic bond

Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle - lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarization- polarizing 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; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB2, AB3 and AB4. Partial ionic character of covalent bond - dipole moment, application to molecules of the type A2, AB and AB2. Percentage ionic character - numerical problems based on calculation of percentage. ionic character.

Unit - IV	Structure and bonding - II	12 Hours

VB theory application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species - CO_2, NO_2, CO 2-, NO_3- ; limitations of VBT; MO theory - bonding, Anti bonding and nonbonding orbital's, bond order; MO diagrams of H_2, O_2, O_2+, N_2, HF, CO. Magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of BF_3, NH_3 _ properties 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 and its types.

Unit - V	Basic concepts in Organic Chemistry and Electronic effects	12 Hours

Types of bond cleavage - heterolytic and homolytic; reagents and substrates; types of reagents – electrophiles, nucleophiles, free radicals; reaction intermediates - carbanions, carbocations, carbenes, arynes and nitrenes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects. Resonance - resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals. Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane.

Text Book(s):

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

Reference Books:

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

Web Resources:

1) https://onlinecourses.nptel.ac.in
2) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html
3) https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding
4) https://www.mooc-list.com/tags/chemical-bonding
5) https://onlinecourses.swayam2.ac.in/cec24_cy04/preview

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes: Upon successful completion of this course, the student will be able to		
COs	**Statements**	**Bloom's Level**
CO1	Explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.	K1
CO2	Classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.	K2
CO3	Apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx, Δp electro negativity, percentage ionic character and bond order.	K3
CO4	Evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects.	K4
CO5	Construct MO diagrams, predict 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, K6 – Create		

Mapping (COs vs POs)									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: I	Course Code: 23UCHCCP01	Hours/Week: 0+0+3	Credit: 3
COURSE TITLE : CORE COURSE PRACTICAL I - QUANTITATIVE INORGANIC ESTIMATIONS (TITRIMETRY) AND INORGANIC PREPARATIONS			

Course Overview:

1. This course covers information about apparatus.
2. These courses provide awareness in chemical laboratory safety.
3. In this course covers the knowledge on principle of quantitative estimation.
4. This course information on inorganic preparation and estimation.

Learning Objectives:

1. To providing knowledge on laboratory safety.
2. To understand the knowledge on handling glass wares.
3. To familiarizing knowledge on quantitative estimation.
4. To providing knowledge on preparation.
5. To discuss the estimation of inorganic compounds.

Unit - I	Chemical Laboratory Safety in Academic Institutions (Not for Examination)	12 Hours

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.

Unit - II	Quantitative Estimation(Volumetric)	12 Hours

Acidimetry and Alkalimetry

Estimation of hydrochloric acid.

Estimation of sodium hydroxide.

Permanganometry

Estimation of oxalic acid.

Estimation of ferrous iron.

Dichrometry

Estimation of ferric alum.

Estimation of ferrous iron.

Iodometry

Estimation of copper in copper sulphate.

Unit - III	Complexometry Estimations and Preparation of Inorganic compounds	12 Hours

Estimation of Zn and Mg using EDTA.

Estimation of hardness of water.

Estimations

Estimation of iron in iron tablets.

Estimation of ascorbic acid.

Preparation of Inorganic compounds

Potash alum.

Tetraammine copper (II) sulphate.

Microcosmic salt.

Mohr's Salt.

Text Book(s):

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

Reference Books:

1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand &Sons: New Delhi, 1997.
2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; An advanced course in Practical Chemistry, 3rd ed.; New Central Book Agency: Kolkata, 2007.

Web Resources:

1. http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis
2. https://chemdictionary.org/titration-indicator/
3. https://archive.nptel.ac.in/courses/104/106/104106121/
4. https://www.my-mooc.com/en/mooc/basic-analytical-chemistry/
5. https://archive.nptel.ac.in/noc/courses/noc20/SEM1/noc20-cy02/

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Explain the basic principles involved in titrimetric analysis and inorganic preparations.	K1
CO2	Compare the methodologies of different titrimetric analysis.	K2
CO3	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
CO4	Assess the yield of different inorganic preparations and identify the end point of various titrations.	K4
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: I	Course Code: 23UCHSE01	Hours/Week: 1+0+0	Credit: 2
COURSE TITLE : NON MAJOR ELECTIVE COURSE - FOOD CHEMISTRY			

Course Overview:

1. This course covers information on food poison.
2. These courses provide awareness about adulteration.
3. In this course covers the food additives.
4. These courses give knowledge on edible oils.

Learning Objectives:

1. To providing knowledge on types of food.
2. To give the awareness on food adulteration.
3. To providing information on food additives and preservation.
4 To familiarizing in food poison.
5 To discuss the data on edible oils.

Unit - I	Food Adulteration	03 Hours

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.

Unit - II	Food Poison	02 Hours

Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) - Chemical poisons - First aid for poison consumed victims.

Unit - III	Food Additives	03 Hours

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.

Unit - IV	Beverages	02 Hours

Beverages-soft drinks-soda-fruit juices - alcoholic beverages-examples. Carbonation-addiction to alcohol - diseases of liver and social problems.

Unit - V	Edible Oils	02 Hours

Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases - determination of iodine value, RM value, saponification values and their significance.

Text Book(s):

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006.
3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishning house, 2010.
4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022.
5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Pdmini S Ghugre, New age international publishers, second edition, 2021.

Reference Books:

1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4th Edition, 2009.
2. M.S waminathan, Food Science and Experimental Foods, Ganesh and Company,1979.
3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008.
4. Food science, Srilakshmi. B, New Age International, 2003.
5. Food chemistry, Ramani. Alex V, MJP Publisher, first edition, 2009.

Web Resources:

1. https://onlinecourses.swayam2.ac.in/cec20_ag10/preview
2. https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/127
3. https://www.technologyed.com/courses/food-chemistry-online-course-certificate/
4. https://www.coursera.org/courses?query=food%20science
5. http://ecoursesonline.iasri.res.in/course/view.php?id=89

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes: Upon successful completion of this course, the student will be able to		
COs	**Statements**	**Bloom's Level**
CO1	learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter.	K1
CO2	get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion.	K2
CO3	get an exposure on food additives, artificial sweeteners, Saccharin, Cyclomate and A spartate in the food industries.	K3
CO4	acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.	K4
CO5	study about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA.	K5
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: I	Course Code: 23UCHFC01	Hours/Week: 2+0+0	Credit: 2
COURSE TITLE : FOUNDATION COURSE IN CHEMISTRY			

Course Overview:

1. This course covers the basic concepts of organic chemistry.
2. These courses provide the lab safety measures.
3. In this course covers the importance of periodic table.
4. This course given knowledge about redox chemistry.

Learning Objectives:

1. To understand the lab safety measures.
2. To outline the basic concepts of organic chemistry.
3. To describe the importance of periodic table.
4. To explain the fundamentals of physical properties.
5. To understand the importance of redox chemistry.

Unit - I	Chemistry Lab - General Awareness and First Aid Techniques	05 Hours

Safety in chemistry lab - introduction to laboratory glass wares - storage and handling of chemicals - carcinogenic chemicals - handling of ethers - toxic and poisonous chemicals. Burns and damages due to organic substances - acids, alkalies - burns in the eye - inhalation of toxic vapours - hazardous chemicals - dealing with bromine, phenol and hot objects.

Unit - II	Introduction to Organic Chemistry	05 Hours

Catenation - Classification - Homologous Series - General Molecular Formula - Functional Groups - General and IUPAC Nomenclature - Modern concept of bonding in organic molecules, sp^3, sp^2 and sp hybridization in carbon by taking methane, ethane and benzene as examples.

Unit - III	Introduction to Inorganic Chemistry	05 Hours

Atomic orbitals and concept of atomic orbitals - shape of s,p and d orbitals - periodic table and the classification of elements - Electronic configuration of elements, Types of Chemical bonds - Schematic Illustration of bonds.

Unit - IV	Introduction to Physical Chemistry	05 Hours

Units - Fundamental units - derived units and SI Units - Significant Figures - States of matter - types - properties of solids, liquids and gases - solid state - types of solids - amorphous and

crystalline solids - properties of liquids and gases.

Unit - V	Basic concepts of Redox Chemistry	04 Hours

Definition - oxidation and reduction reactions - calculation of oxidation numbers - Equivalent weight - definition - calculation of equivalent weight of acids, bases and salts. Reduction potential and electrochemical series.

Text Book(s):

1) B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 33rd Edition, Milestone Publishers and Distributors, New Delhi, India (2020).
2) Arub Bahl, B.S. Bahl, A Text Book of Organic Chemistry, 22nd Edition, S. Chand & Co (2019).
3) B.R. Puri, L.R. Sharma & M.S. Pathania, Principles of Physical Chemistry, 48th Edition, Vishal Publishing Co (2020).
4) Madan, R. D. and Sathya Prakash, Modern Inorganic Chemistry, 2nd ed.; S. Chand and Company: New Delhi, 2003.
5) Maron, S. H. and Prutton C. P. Principles of Physical Chemistry,4th ed.; The Macmillan Company: Newyork,1972.

Reference Books:

1) P.L. Soni, D.B. Dharmarke, Text book of Physical Chemistry, S. Chand & Co.
2) Gurudeep Raj Advanced Inorganic Chemistry, 26th ed. Goel Publishing House: Meerut, 2001.
3) Atkins, P.W. & Paula, J. Physical Chemistry, 10th ed.; Oxford University Press: New York, 2014.
4) Huheey, J. E. Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed .; Addison, Wesley Publishing Company: India,1993.

Web Resources:

1) https://www.mooc-list.com/tags/organic-chemistry
2) https://onlinecourses.swayam2.ac.in/cec22_cy02/preview
3) https://onlinecourses.nptel.ac.in/noc22_cy02/preview
4) https://www.mooc-list.com/tags/inorganic-chemistry
5) https://www.mooc-list.com/tags/physical-chemistry

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Understand the lab safety measures.	K1
CO2	Discuss the introduction of organic chemistry.	K2
CO3	Understanding the basic inorganic chemistry.	K3
CO4	Knowing the concept of the basic physical chemistry.	K4
CO5	Understand the basic concepts of redox chemistry.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: II	Course Code: 23UCHCC02	Hours/Week: 4+2+0	Credit: 5
COURSE TITLE : CORE COURSE II - GENERAL CHEMISTRY - II			

Course Overview:

1. This course covers chemistry of acids, bases and ionic equilibrium.
2. These courses generally provide the properties of s and p-block elements.
3. In this course covers information of main block elements and hydrocarbons.
4. This course introduces the properties of s and p-block elements.

Learning Objectives:

1. To provide information in chemistry of acids, bases and ionic equilibrium.
2. To understand knowledge in properties of s and p-block elements.
3. To outline the concept in chemistry of hydrocarbons.
4. To give the applications of acids and bases.
5. To provide information of main block elements and hydrocarbons.

Unit - I	Acids, Bases and Ionic equilibria	10 Hours

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. Buffer solutions - types, mechanism of buffer action in acid and basic buffer, Henderson - Hassel bach equation. Solubility product - determination and applications; numerical problems involving the core concepts.

Unit - II	Chemistry of s - Block Elements and p- Block Elements (Group 13 & 14)	10 Hours

Chemistry of s - Block Elements

Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. preparation, alkaline earth metals. Anomalous behaviour of Be.

Chemistry of p- Block Elements (Group 13 & 14)

Preparation and structure of diborane and borazine - Chemistry of borax - Extraction of Al and its uses - Alloys of Al. Comparison of carbon with silicon - Carbon-di-sulphide - Preparation, properties, structure and uses - Per carbonates, perm no carbonates and per dicarbonates.

Unit - III	Chemistry of p- Block Elements (Group 15-18)	10 Hours

General characteristics of elements of Group - 15; Chemistry of H_2N - NH_2 and NH_2OH. Chemistry of PH_3, PCl_3 and PCl_5 - Oxy acids of phosphorous H_3PO_3 and H_3PO_4. General properties of elements of Group - 16 - Structure and allotropy of ozone - Classification and properties of oxides. Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI),. Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7). Noble gases: Position in the periodic table. Preparation, properties and structure of XeF_2, XeF_4 and $XeOF_4$.

Unit - IV	Hydrocarbon Chemistry-I	09 Hours

Alkenes

Nomenclature, Mechanism of β – elimination reactions - E1 and E2 mechanism. Reactions of alkenes - addition reactions - mechanisms - Markownikoff's rule, Anti markownikoff's rule - oxidation reactions - hydroxylation, epoxidation, ozonolysis.

Alkadienes

Nomenclature - classification - isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes – Diels - Alder reactions.

Cycloalkanes

Nomenclature, preparation, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane. Chair and boat conformation of cyclohexane.

Unit - V	Hydrocarbon Chemistry – II	09 Hours

Benzene: Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Ortho, para, meta directing in mono substituted benzene.

Text Book(s):

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed, S.Chand and Company, New Delhi.
2. Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S. Chand and Company, New Delhi.

3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S. Chand and Company, New Delhi.
4. Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi.
5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry,38th ed., Vishal Publishing Company, Jalandhar.

Reference Books:

1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, New york.
2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi.
3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London.
4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India.
5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed., Goel Publishing House, Meerut.
6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8th ed., Goel Publishing House, Meerut.

Web Resources:

1. https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html
2. MOOC components http://nptel.ac.in/courses/104101090/
3. Lecture 1: Classification of elements and periodic properties http://nptel.ac.in/courses/104101090/

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons.	K1
CO2	Discuss the periodic properties of sand p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids.	K2
CO3	Classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons.	K3
CO4	Explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements	K4
CO5	Assess the application of hard and soft acids indicators, buffers, compounds of s and p- block elements and hydrocarbons.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: II	Course Code: 23UCHCCP02	Hours/Week: 0+0+3	Credit: 3
COURSE TITLE : CORE COURSE PRACTICAL II - QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS			

Course Overview:

1. This course covers how to handling the glass wares.
2. These courses generally provide knowledge on laboratory safety.
3. In this course covers on analysis of organic compouns.
4. This course introduces the basic concepts purification technique.

Learning Objectives:

1. To providing knowledge on laboratory safety.
2. To give knowledge on handling glass wares.
3. To outline the knowledge on analysis of organic compounds.
4. To providing knowledge on preparation of organic compounds.
5. To discuss the purification technique.

Unit - I	Safety rules (Not for Examination)	12 Hours

Safety rules, symbols and first-aid in chemistry laboratory. Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware - basis information and uses.

Unit - II	Qualitative Organic Analysis	12 Hours

Preliminary examination, detection of special elements - Nitrogen, Sulphur and Halogens Aromatic and Aliphatic nature, Test for Saturation and Unsaturation, Identification of functional groups using solubility tests Confirmation of functional groups

- Monocarboxylic acid, Dicarboxylic acid
- Monohydric phenol, Dihydric phenol
- Aldehyde, Ketone, Ester
- Carbohydrate (Reducing and Non-reducing sugars)
- Primary amine
- Monoamide, Diamide
- Anilide
- Preparation of derivatives for the functional groups.

Unit - III	Preparation of Organic Compounds	12 Hours

- Preparation of p-Bromo acetanilide from Acetanilide (Halogenation).

- Preparation of Benzoic acid from Methyl benzoate.
- Preparation of Salicylic acid from Methyl Salicylate.

Separation and Purification Techniques (Not for Examination)

i) Purification of organic compounds by crystallization (from water / alcohol)and distillation

ii) Determination of melting and boiling points of organic compounds.

iii) Steam distillation - Extraction of essential oil from citrus fruits/eucalyptusleaves.

Chromatography (Group experiment - Not for Examination)

Separation of amino acids by Paper Chromatography

(i) Thin Layer Chromatography - mixture of sugars / plant pigments /permanganate dichromate.

(ii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate.

Text Book(s):

1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012.
2. Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018.
3. Gurtu, J. N; Kapoor, R. Advanced Experimental Chemistry (Organic), Sultan Chand: New Delhi, 1987.
4. Furniss,B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, 5th ed.; Pearson: India,1989.

Reference Books:

1. Vogel A.I.., A Text Book of Qualitative Analysis including semi-micromethods,

Web Resources:

1. https://www.vlab.co.in/broad-area-chemical-sciences
2. https://www.youtube.com/watch?v=O9ba90MJws0
3. https://www.youtube.com/watch?v=oz1LNl90SSU
4. https://www.youtube.com/watch?v=QQo1e-BUZWs

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Observe the physical state, odour, colour and solubility of the given organic compound.	K1
CO2	Identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.	K2
CO3	Compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non- reducing sugars and explain the reactions behind it.	K3
CO4	Exhibit a solid derivative with respect to the identified functional group.	K4

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: II	Course Code: 23UCHSE02	Hours/Week: 2+0+0	Credit: 2
COURSE TITLE : NON MAJOR ELECTIVE COURSE - DAIRY CHEMISTRY			

Course Overview:

1. This course covers about milk products.
2. These courses generally provide the information to processing of milk.
3. In this course covers the fermented milk products.
4. This course introduces the basic concepts in composition of milk.

Learning Objectives:

1. To give the knowledge in milk and milk products.
2. To understand processing of milk.
3. To providing knowledge in preservation and formation of milk products.
4 To outline the information in composition of milk.
5 To discuss the details in fermented milk products.

Unit - I	Composition of Milk	05 Hours

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 - adulterants, preservatives with neutralizer - examples and their detection - estimation of fat, acidity and total solids in milk.

Unit - II	Processing of Milk	05 Hours

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 HTST (High Temperature Short Time) - Vacuum pasteurization - Ultra High Temperature Pasteurization.

Unit - III	Major Milk Products	05 Hours

Cream - definition - composition – chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition – composition - theory of churning - estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity - definition - prevention - antioxidants and synergists – natural and synthetic.

Unit - IV	Special Milk	04 Hours

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.

Unit - V	Fermented and other Milk Products	05 Hours

Fermented milk products - fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - acidophilus milk – Ice cream - definition - percentage composition - types - ingredients-manufacture of ice cream, stabilizers - emulsifiers and their role - milk powder - definition - need for making milk powder - drying process - types of drying.

Text Book(s):

1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006.
2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974.
3. Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1 st edition, 2008.
4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition, 2013.
5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.

Reference Books:

1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005.
2. F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006.
3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980.
4. P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016.
5. Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke – Lowe, P.L.H. Mc Sweeney, J.A. O Mahony, Springer, Second edition, 2015.

Web Resources:

1) https://www.mooc-list.com/tags/dairy-production
2) https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/77
3) https://onlinecourses.nptel.ac.in/noc19_ag05/preview

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Understand about general composition of milk – constituents and its physical properties.	K1
CO2	Acquire knowledge about pasteurization of Milk and various types of pasteurization -Bottle, Batch and HTST Ultra High Temperature Pasteurization.	K2
CO3	Learn about Cream and Butter their composition and how to estimate fat in cream andGhee.	K3
CO4	Explain about Homogenized milk, flavored milk, vitaminised milk and toned milk.	K4
CO5	Have an idea about how to make milk powder and its drying process - types of drying process.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: II	Course Code: 23UCHSE01	Hours/Week: 2+0+0	Credit: 2
COURSE TITLE : SKILL ENHANCEMENT COURSE I - COSMETICS AND PERSONAL CARE PRODUCTS			

Course Overview:

1. This course covers the hair, skin and dental care.
2. These courses provide makeup preparations.
3. In this course covers the types of cosmetics and their significance.
4. This course introduces the basic concepts in beauty treatments.

Learning Objectives:

1. To familiarizing the formulations of various types of cosmetics and their significance.
2. To understand the hair, skin and dental care.
3. To discuss the details in makeup preparations and personal grooming.
4. To providing knowledge in perfumes.
5. To outline the information in beauty treatments.

Unit - I	Skin Care	05 Hours

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.

Unit - II	Hair Care and Dental Care	05 Hours

Hair Care - Shampoos - types - powder, cream, liquid, gel – ingredients; conditioner – types - ingredients

Dental care - Tooth pastes - ingredients - mouth wash.

Unit - III	Make Up	04 Hours

Base - foundation - types - ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouges.

Unit - IV	Perfumes	05 Hours

Classification - Natural - plant origin - parts of the plant used, chief constituents; animal origin - amber gries from whale, civetone from civet cat, musk from musk deer; synthetic - classification emphasizing characteristics - esters - alcohols - aldehydes – ketones.

Unit - V	Beauty treatments	05 Hours

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.

Text Book(s):

1. Ayaz Mahmood Dar., Cosmetic Chemistry: An Instant Approach, Kindle Edition, 2018.
2. Perry Romanowski, Perry Romanowski, Beginning Cosmetic Chemistry, Allured Pub Corp, 2009.
3. Florence Barrett-Hill, Ralph Hill, Cosmetic Chemistry, Virtual Beauty Corporation, 2009 .

Reference Books:

1. Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed., Chemical Publishers, London.
2. George Howard, (1987) Principles and practiceof perfumes and cosmetics, Stanley Therones, Chettenham.

Web Resources:

1. http://www.khake.com/page75.html
2. Net.foxsm/list/284

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Know about the composition of various cosmetic products.	K1
CO2	Understand chemical aspects and applications of hair care and dental care and skincare products.	K2
CO3	Understand chemical aspects and applications of perfumes and skin care products.	K3
CO4	To understand the methods of beauty treatments their advantages and disadvantage.	K4
CO5	Understand the hazards of cosmetic products.	K5
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: I/III	**Course Code: 23UCHGEA01**	**Hours/Week: 3+0+0**	**Credit: 3**
COURSE TITLE : ALLIED - CHEMISTRY FOR PHYSICAL SCIENCES - I			

Course Overview:

1. This course covers information on chemical bonding.
2. These courses provide knowledge about industrial preparations.
3. In this course covers the fundamental concept of organic chemistry.
4. These courses give knowledge about thermodynamic properties.

Learning Objectives:

1. To understand the basics of atomic orbital's, chemical bonds, hybridization.
2. To outline the concepts of thermodynamics and its applications.
3. To discuss the details in concepts of nuclear chemistry.
4 To providing knowledge on importance of chemical industries.
5 To familiarizing qualitative and analytical methods.

Unit - I	**Chemical Bonding and Nuclear Chemistry**	**08 Hours**

Chemical Bonding: Molecular Orbital Theory - bonding, antibonding and non - bonding orbitals. M. O 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.

Unit - II	Industrial Chemistry	07Hours

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.

Unit - III	Fundamental Concepts in Organic Chemistry	07 Hours

Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Polar effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric - examples and explanation. Reaction mechanisms: Types of reactions – aromaticity - aromatic electrophilic substitution; nitration, halogenation, Friedel - Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

Unit - IV	Thermodynamics and Phase Equilibria	07 Hours

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

Unit - V	Analytical Chemistry	07 Hours

Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.

Text Book(s)

1) V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2) S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3) Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.

4) P.L .Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth editions, 2007.

Reference Books:

1) P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2) B.R.Puri, L.R.Sharma, M.S.Pathania,Textbook Physical Chemistry; Visual Publishing Co., New Delhi, forty seventh edition, 2018.
3) B.K,Sharma, Industrial Chemistry; GOEL publishing house,Meerut, sixteenth edition, 2014.

Web Resources:

1) https://www.mooc-list.com/tags/chemical-bonding
2) https://onlinecourses.nptel.ac.in/noc20_cy18/preview
3) https://analytical.chem.ut.ee/teaching/moocs/
4) https://onlinecourses.nptel.ac.in/noc23_cy27/preview
5) https://onlinecourses.swayam2.ac.in/cec23_cy03/preview

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.	K1
CO2	Evaluate the efficiencies and uses of various fuels and fertilizers.	K2
CO3	Explain the type of hybridization, electronic effect and mechanism involved in theorganic reactions.	K3
CO4	Apply various thermodynamic principles, systems and phase rule.	K4
CO5	Explain various methods to identify an appropriate method for the separation of chemical components	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L - Low

Semester: II/IV	Course Code: 23UCHGEA02	Hours/Week: 3+0+0	Credit: 3
COURSE TITLE : ALLIED - CHEMISTRY FOR PHYSICAL SCIENCES - II			

Course Overview:

1. This course covers information carbohydrates and amino acids.
2. These courses provide knowledge about co-ordination chemistry and water technology.
3. In this course covers the various photochemical phenomenon's.
4. These courses give knowledge on basics and applications of electrochemistry.

Learning Objectives:

1. To understand the basics of co-ordination chemistry and water technology.
2. To outline the concepts of carbohydrates and amino acids.
3. To discuss the details of basics and applications of electrochemistry.
4. To providing knowledge on basics and applications of kinetics and catalysis.
5. To familiarizing various photochemical phenomenon.

Unit - I	Co-ordination Chemistry and Water Technology	08 Hours

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 Hemoglobin 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 and COD.

Unit - II	Carbohydrates and Amino acids	07 Hours

Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose – fructose Inter conversion. 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).

Unit - III	Electrochemistry	07 Hours

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.

Unit - IV	Kinetics and Catalysis	07 Hours

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.

Unit - V	Photochemistry	07 Hours

Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen - chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

Text Book(s):

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

Reference Books:

1) P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007
2) B.R. Puri, L.R. Sharma, M.S. Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
3) B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Web Resources:

1) https://onlinecourses.swayam2.ac.in/cec22_ag09/preview
2) https://onlinecourses.nptel.ac.in/noc23_cy26/preview
3) https://onlinecourses.nptel.ac.in/noc23_mm48/preview

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Write the IUPAC name for complex, different theories to explain the bonding incoordination compounds and water technology.	K1
CO2	Explain the preparation and property of carbohydrate, amino acids and nucleic acids.	K2
CO3	Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuelcells.	K3
CO4	Identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.	K4
CO5	Outline the various type of photochemical process.	K5
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: I/III	Course Code: 23UCHGEB01	Hours/Week: 3+0+0	Credit: 3
COURSE TITLE : ALLIED COURSE III - CHEMISTRY FOR BIOLOGICAL SCIENCES - I			

Course Overview:

1. This course covers information on chemical bonding.
2. These courses provide knowledge about industrial preparations.
3. In this course covers the fundamental concept of organic chemistry.
4. These courses give knowledge about analytical properties.

Learning Objectives:

1. To understand the basics of atomic orbital's, chemical bonds, hybridization.
2. To outline the concepts of thermodynamics and its applications.
3. To discuss the details in concepts of nuclear chemistry.
4 To providing knowledge on drugs and specialty chemicals.
5 To familiarizing qualitative and analytical methods.

Unit - I	Chemical Bonding and Nuclear Chemistry	03 Hours

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O 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.

Unit - II	Industrial Chemistry	02 Hours

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.

Unit - III	Fundamental Concepts in Organic Chemistry	03 Hours

Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6.
Polar effects: Inductive effect and consequences on Ka and Kb of organic acids and bases,

electromeric, mesomeric, hyper conjugation and steric - examples and explanation.

Reaction mechanisms: Types of reactions – aromaticity - aromatic electrophilic substitution; Nitration, halogenation, Friedel - Craft's alkylation and acylation.

Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

Unit - IV	Drugs and Speciality Chemicals	02 Hours

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.

Unit - V	Analytical Chemistry	02 Hours

Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization.

Chromatography: principle and application of column, paper and thin layer chromatography.

Text Book(s):

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

Reference Books:

1) P.L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2) B.K, Sharma, Industrial Chemistry; GOEL publishing house,Meerut, sixteenth edition, 2014.
3) Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

Web Resources:

1) https://www.mooc-list.com/tags/chemical-bonding
2) https://onlinecourses.nptel.ac.in/noc20_cy18/preview
3) https://analytical.chem.ut.ee/teaching/moocs/
4) https://onlinecourses.nptel.ac.in/noc23_cy27/preview
5) https://onlinecourses.swayam2.ac.in/cec23_cy03/preview

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	State the theories of chemical bonding, nuclear reactions and its applications.	K1
CO2	Evaluate the efficiencies and uses of various fuels and fertilizers.	K2
CO3	Explain the type of hybridization, electronic effect and mechanism involved in theorganic reactions.	K3
CO4	Demonstrate the structure and uses of antibiotics, anesthetics, antipyretics and artificial sugars.	K4
CO5	Analyze various methods to identify an appropriate method for the separation ofchemical components.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: II/IV	Course Code: 23UCHGEB02	Hours/Week: 3+0+0	Credit: 3
COURSE TITLE : ALLIED COURSE IV - CHEMISTRY FOR BIOLOGICAL SCIENCES - II			

Course Overview:

1. This course covers information carbohydrates and amino acids.
2. These courses provide knowledge about co-ordination chemistry and water technology.
3. In this course covers the various photochemical phenomenon's.
4. This course gives knowledge on basics and applications of electrochemistry.

Learning Objectives:

1. To understand the basics of co-ordination chemistry and water technology.
2. To outline the concepts of carbohydrates and amino acids.
3. To discuss the details of basics and applications of electrochemistry.
4. To providing knowledge on amino acids and essential elements of bio system.
5. To familiarizing various photochemical phenomenon.

Unit - I	Co-ordination Chemistry and Water Technology	03 Hours

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 Hemoglobin 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 and COD.

Unit - II	Carbohydrates	02 Hours

Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose inter conversion. Preparation and properties of sucrose, starch and cellulose.

Unit - III	Amino Acids and Essential elements of bio system	03 Hours

Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification - structure - Colour reactions - Biological functions - nucleosides -nucleotides - RNA and DNA - structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.

Unit - IV	Electrochemistry	02 Hours

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials - electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conduct metric 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.

Unit - V	Photochemistry	02 Hours

Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen - chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

Text Book(s):

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

Reference Books:

1) Arun Bahl, B.S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012.
2) P.L. Soni, H.M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
3) P.L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007
4) B.R. Puri, L.R. Sharma, M.S. Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
5) B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Web Resources:

1) https://onlinecourses.swayam2.ac.in/cec22_ag09/preview
2) https://onlinecourses.nptel.ac.in/noc23_cy26/preview
3) https://onlinecourses.nptel.ac.in/noc23_mm48/preview

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Write the IUPAC name for complex, different theories to explain the bonding incoordination compounds and water technology.	K1
CO2	Explain the preparation and property of carbohydrate.	K2
CO3	Enlighten the biological role of transition metals, amino acids and nucleic acids.	K3
CO4	Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuelcells.	K4
CO5	Outline the various type of photochemical process.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: II/III	Course Code: 23UCHGAP01	Hours/Week: 0+0+2	Credit: 1
COURSE TITLE : ALLIED PRACTICAL - I CHEMISTRY FOR PHYSICAL AND BIOLOGICAL SCIENCES - I			

Course Overview:

1. This course covers information on preparation of standard solutions.
2. These courses provide principles and practical experience of volumetric analysis.
3. In this course covers the estimation technique.
4. This course give knowledge on skill fully handles the laboratory equipments, reagents, lab apparatus.

Learning Objectives:

1. To know the basics preparation of standard solutions.
2. To understand the principles and practical experience of volumetric analysis.
3. To inculcate the student show to skill fully handles the laboratory equipments, reagents, lab apparatus.
4. To understand the estimation technique.
5. To understanding of the use of indicators.

Unit - I	VOLUMETRIC ANALYSIS	24 Hours

1. Estimation of sodium hydroxide.
2. Estimation of hydrochloric acid.
3. Estimation of ferrous sulphate.
4. Estimation of oxalic acid.
5. Estimation of potassium permanganate.
6. Estimation of hardness of water.
7. Estimation of ferrous ion.

Text Book(s):

1) Basic Principles of Practical Chemistry, Kulandaivelu A.R., Veeraswamy R. Venkateswaran, Sultan Chand & Sons, 2017.
2) Practical Chemistry, Pandey D.N., Sultan Chand Publishers,2018.

Reference Books:

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

2) Vogel's Text book of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Fifth Edition, Bath Press, Great Britan, 1989.

3) Vogel's Textbook of Quantitative Chemical Analysis, GH Jeffery, J Bassett, J Mendham, RC Denney, Fifth Edition, Bath Press, Great Britan,1989.

Web Resources:

1) https://nptel.ac.in/courses/104/106/104106108/
2) https://www.youtube.com/watch?v=n4esSHxz_J8
3) http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html/
4) https://www.youtube.com/watch?v=7bmQkQW8bbs
5) https://www.youtube.com/watch?v=wRAo-M8xBHM

Teaching Methodology: Videos, Audios, PPT, Role Play, QUIZ, Filed visit, Seminar, Chalk & Talk, Lecturing, Case study, Demonstration, Problem solving, Group discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.	K1
CO2	Design, carry out, record and interpret the results of volumetric titration.	K2
CO3	Apply their skill in the analysis of water/hardness.	K3
CO4	Analyze the chemical constituents in allied chemical products.	K4
CO5	Gain an understanding of the use of indicators.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: II/IV	Course Code:23UCHGAP02	Hours/Week: 0+0+2	Credit: 1
COURSE TITLE : ALLIED PRACTICAL II - CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES - II			

Course Overview:

1. This course covers information on identification of organic functional groups.
2. These courses provide the knowledge of different types of organic compounds with respect to their properties.
3. In this course covers the identification of elements in organic compounds.

Learning Objectives:

1. To understand the identification of organic functional groups.
2. To know the different types of organic compounds with respect to their properties.
3. To determination of elements in organic compounds.
4. To impart the first-hand knowledge and experience on estimation of anion, acid and base both directly as well as indirectly.
5. To make the student skilful enough and prepare for a position in an analytical laboratory.

Unit - I	Systematic Analysis Of Organic Compounds	24 Hours

The analysis must be carried out as follows:

(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].

(b) Detection of elements (N, S, Halogens).

(c) To distinguish between aliphatic and aromatic compounds.

(d) To distinguish - Saturated and unsaturated compounds.

Text Book(s):

1) Basic Principles of Practical Chemistry, Kulandaivelu A.R., Veeraswamy R. Venkateswaran, Sultan Chand &Sons, 2017.

2) Practical Chemistry, Pandey D.N., Sultan Chand Publishers,2018.

Reference Books:

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

2) Vogel's Text book of Practical Organic Chemistry, Brian S. Furniss, Antony J.Hannaford,PeterW. G. Smith, Fifth Edition, Bath Press, Great Britan,1989 .

3) Vogel's Textbook of Quantitative Chemical Analysis, GHJeffery, JBassett, J Mendham, RC Denney, Fifth Edition, Bath Press, Great Britan,1989.

Web Resources:

1) https://nptel.ac.in/courses/104/106/104106108/
2) https://www.youtube.com/watch?v=n4esSHxz_J8
3) http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html/
4) https://www.youtube.com/watch?v=7bmQkQW8bbs
5) https://www.youtube.com/watch?v=wRAo-M8xBHM

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Analyze the chemical constituents in allied chemical products.	K1
CO2	Analyze the groups/elements present in the given organic substance.	K2
CO3	Analyze the characters present in the given organic substance through qualitative analysis.	K3
CO4	Prepare a suitable derivative through qualitative analysis.	K4
CO5	Distinguish the aliphatic and aromatic compounds through qualitative analysis.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: II	Course Code:	Hours/Week: 1+0+0	Credit:
COURSE TITLE : FUEL CHEMISTRY & CHEMISTRY OF COSMETICS & PERFUMES (ADD ON COURSE)			

Course Overview:

1. This course covers information on energy sources.
2. These courses provide the knowledge about lubricants.
3. In this course covers the knowledge on consumer product.

Learning Objectives:

1. To understand the energy sources.
2. To know the fuels in distillation techniques.
3. To give the information about lubricants.
4. To familiar about consumer product.
5. To make the student skilful enough and prepare for a consumer product.

Unit - I	Energy sources	4 Hours

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value. Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas-composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Unit - II	Fuels	4 Hours

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels.

Unit - III	Lubricants	4 Hours

Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

Unit - IV	Consumer product-I	4 Hours

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and

shaving creams), antiperspirants and artificial flavors.

Unit - V	Consumer product-II	4 Hours

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

Text Book(s):

1. E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK.
2. P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).

Reference Books:

1. Stocchi, E. Industrial Chemistry, Vol - I, Ellis Horwood Ltd. UK (1990).
2. Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).

Web Resources:

1. https://www.youtube.com/watch?v=jo_IRDLLSNU
2. https://www.youtube.com/watch?v=85Jo22sFTrs&list=PLHWPZcIu1IxCaUBw-BmQ6b2XKm6rRoO8r

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Understand the energy sources.	K1
CO2	Know the fuels in distillation techniques.	K2
CO3	Give the information about lubricants.	K3
CO4	Familiar about consumer product.	K4
CO5	Make the student skilful enough and prepare for a consumer product.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L - Low

Semester: II	**Course Code:**	**Hours/Week: 1+0+0**	**Credit:**
COURSE TITLE : PETROLEUM INDUSTRIES IN INDIA (CERTIFICATE COURSE)			

Course Overview:

1. This course covers information on fuels.
2. These courses provide the knowledge of petroleum and petrochemical industries.
3. In this course covers the knowledge on catalysts in petroleum industry.

Learning Objectives:

1. To understand the information on fuels.
2. To know about the petroleum and petrochemical industry.
3. To know the information on Indian petrochemical industry.
4. To be familiar the catalysts in petroleum industry.
5. To make the student aware about the pollution from petroleum industry.

Unit - I	**Fuels**	**4 Hours**

Energy crisis - coal as an alternative to oil – Hydrogen - fuel of tomorrow - advantages – nonconventional sources of energy — solar energy — bio gas – advantages - tidal energy – geothermal energy - wind energy — nuclear fuels (general study only).

Unit - II	**Petroleum and petrochemical industry**	**4 Hours**

Importance of Petroleum and petrochemical industry in the contest of Indian economy – general Cost - capital cost - production cost – R & D economics - Major govt oil companies engaged in refining and marketing petroleum, Function of ONGC.

Unit - III	Indian petrochemical industry	4 Hours

Difficulties encountered in Indian petro chemical industries.- Public sector and private sector – Petroleum conception pattern Indian reserves, Developments in petrochemical industry - developments in quality of petroleum fuels and future – Future of petrochemical industry.

Unit - IV	Catalysts in petroleum industry	4 Hours

General properties-classification — catalytic activity catalysts in refining process - Reforming catalysts - hydro treating catalysts - catalysts in petro chemical industry - Ziegler catalyst – preparation – properties – disadvantages - miscellaneous polymerization catalysts - recent advances in catalysts - Role of polymers in catalysts - enzyme catalysts - preparation, structure, selectivity and Application.

Unit - V	Pollution from petroleum industry	4 Hours

Refinery pollution - water pollution — air pollution - sea water pollution - effect of oil pollution - physical and chemical — control methods -- environmental protection -- National standards of air and water pollution.

Text Book(s):

1. W.L. Faith, Donald B Keyes, Ronald L Clark, Industrial Chemicals.
2. Trimn , Catalysts in petrochemical refining.
3. Jain and Jain, Engineering Chemistry.

Reference Books:

1. B.K Sharma, Industrial Chemistry and Chemical Engineering ,Spits Petrochemicals-Wiley.
2. ASTM Methods, Indian standards.
3. Sukumar Maiti, Introduction to Petrochemicals.

Web Resources:

1. https://www.youtube.com/watch?v=vD0kbdIS6kE
2. https://www.youtube.com/watch?v=OQtsBnu41YU

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes: Upon successful completion of this course, the student will be able to		
COs	**Statements**	**Bloom's Level**
CO1	Understand the information on fuels.	K1
CO2	Know about the petroleum and petrochemical industry.	K2
CO3	Know the information on Indian petrochemical industry.	K3
CO4	Familiar the catalysts in petroleum industry.	K4
CO5	The student aware about the pollution from petroleum industry.	K5
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: II	Course Code:	Hours/Week: 1+0+0	Credit:
COURSE TITLE : UNIT OPERATIONS IN CHEMICAL INDUSTRY (VALUE ADDED COURSE)			

Course Overview:

1. This course covers information on distillation of chemical compounds.
2. These courses provide the knowledge on absorption.
3. In this course covers the topic on evaporations.

Learning Objectives:

1. To understand the distillation of chemical compounds.
2. To know the properties of absorption.
3. To identify the evaporation technique.
4. To find out the filtration technique.
5. To know about the Pollution from petroleum industry.

Unit - I	Distillation	4 Hours

Introduction: Boiling point diagrams, distillation methods: equilibrium distillation, differential distillation, rectification, construction of rectifying column, types of down comers, types of columns: Plate columns and packed columns, entrainment.

Unit - II	Absorption	4 Hours

Introduction, selection criteria for Solvent, Gas absorption Equipments: mechanically agitated vessels packed and plate columns, types of tower packing, HETP, Liquid distribution devices.

Unit - III	Evaporation	4 Hours

Introduction: Equipment-short tube (standard) evaporator, forced circulation. evaporators. Falling film evaporators. Climbing film (upward flow) evaporators wiped (agitated) film evaporators.

Unit - IV	Filtration	4 Hours

Introduction: Filter media and filter aids, Equipment - plate and frame filter press, nutch filter, rotary drum filter, sparkler filter, candle filter, bag filter, centrifuge Drying: Introduction: free moisture, bound moisture, drying curve, Equipment-tray dryer, rotary dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.

Unit - V	Pollution from petroleum industry	4 Hours

Crystallization: Introduction: solubility, super saturation, nucleation, crystal growth, techniques to increase crystal size, crystallization from melt. Equipment-tank crystallizer, agitated crystallizer,

evaporator crystallizer, draft tube crystallizer, MSMPR crystallizer.

Text Book(s):

1. W.L. Badger and J.T. Bachero, Introduction to Chemical Engineering, Tata McGraw Hill, U.S.A
2. W.L. McCabe and J.C. Smith, Unit operationsin Chemical Engineering, Tata McGraw Hill N.Y
3. J.H. Perry, Chemical Engineering Hand Book, McGraw Hill, N.Y.
4. D.D. Kale, Unit Operations – 1 and 2, Pune Vidyarthi Griha Prakashan, Pune.

Reference Books:

1. K.A. Gavhane, Unit Operations-II Heat and Mass transfer, Nirali Prakashan.
2. J. D. Seader, Ernest J. Henley and D. Keith Roper, Separation Process Principles, John Wiley & Sons, Inc.
3. J.F. Richardson, J. H. Harker, J. R. Backhurst, Particle Technology and Separation Processes, Butterworth-Heinemann.

Web Resources:

1. https://www.youtube.com/w
2. atch?v=V5ep0-ojPGw
3. https://www.youtube.com/watch?v=kmmEV4ohSDA

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Understand the distillation of chemical compounds.	K1
CO2	Know the properties of absorption.	K2
CO3	Identify the evaporation technique.	K3
CO4	Find out the filtration technique.	K4
CO5	Know about the Pollution from petroleum industry.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: III	**Course Code: 23UCHCC03**	**Hours/Week: 5+3+0**	**Credit: 5**
COURSE TITLE : CORE COURSE III - GENERAL CHEMISTRY - III			

Course Overview:

1. This course covers the applications of nuclear energy.
2. These courses provide the knowledge in fundamentals of nuclear chemistry.
3. In this course covers the applications of nuclear energy.
4. This course introduces the basic concepts on preparation and properties of phenols and alcohols.

Learning Objectives:

1. To understand the physical properties of gases, liquids, solids and X-ray diffraction of solids.
2. To providing knowledge in fundamentals of nuclear chemistry and nuclear waste management.
3. To discuss the applications of nuclear energy
4. To understand the basic chemistry of halo - organic compounds, phenol and other aromatic alcohols.
5. To give outline the preparation and properties of phenols and alcohols.

Unit - I	Gaseous state	12 Hours

Kinetic molecular model of a gas: 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, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path. Real gases: Deviations from ideal gas behavior, compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases - Vander Waal's Equation; Virial equation; Boyle temperature; law of corresponding states - liquefaction of gases; numerical problems involving the core concepts**.**

Unit - II	Liquid and Solid State	12 Hours

Properties of Liquids - Surface tension, viscosity and their applications. Properties of Solids - Crystalline and amorphous - differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Symmetry elements - plane, centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X - ray diffraction - Bragg's equation Defects in solids - stoichio metric and nonstoichio metric defects. Liquid crystals - classification and applications

Unit - III	Nuclear Chemistry	12 Hours

Natural radioactivity - α, β and γ rays; half - life period; Fajan - Soddy group displacement law; Geiger - Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units - Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series. Isotopes - uses - tracers - determination of age of rocks by radiocarbon dating. (Problems to be worked out) Nuclear energy; nuclear fission and fusion - major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.

Unit - IV	Halogen derivatives	12 Hours

Aliphatic halogen derivatives

Nomenclature and classes of alkyl halides - physical properties, Chemical reactions.

Nucleo philic substitution reactions - S_N^1, S_N^2 and S_N^i mechanisms.

Di and Tri Halogen derivatives:

Nomenclature, classification, preparation, properties and applications.

Aromatic halogen compounds

Nomenclature, preparation, properties and uses, mechanism of nucleophilic aromatic substitution - benzyne intermediate.

Aryl alkyl halides

Nomenclature, benzyl chloride - preparation - preparation properties and uses.

Alcohols

Nomenclature, classification, preparation, properties, use; test for hydroxyl groups. Oxidation of diols by per iodic acid and lead tetraacetate.

Unit - V	Phenols	12 Hours

Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process,. Raching process; properties - acidic character and effect of substitution on acidity. Reactions - Fries, Claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimenn, Kolbe, Schmidt, Gatermann synthesis, Libermann reaction.

Text Book(s):

1. B.R. Puri, L.R. Sharma, M.S. Pathania; Principles of Physical Chemistry, 46th edition, Vishal Publishing, 2020.
2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.
3. 4. P.L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, twentieth edition, 2006.
4. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2003.
5. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 1994.

Reference Books:

1. T. W. Graham Solomons, Organic Chemistry, John Wiley & Sons, fifth edition, 1992.
2. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt., Ltd.,New Delhi, seventh edition, 2009.
3. I. L. Finar, Organic Chemistry, Wesley Longman Ltd, England, sixth edition, 1996.
4. P. L. Soni, and H. M. Chawla - Text Book of Organic Chemistry, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.
5. J.D. Lee, Concise Inorganic Chemistry, Blackwell Science, fifth edition, 2005.

Web Resources:

1. https://nptel.ac.in/courses/104104101 Solid state chemistry
2. https://nptel.ac.in/courses/103106071 Nuclear industries and safety
3. https://nptel.ac.in/courses/104106119s Introduction to organic chemistry

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Explain the kinetic properties of gases by using mathematical concepts.	K1
CO2	Describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure exterminations.	K2
CO3	Investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management.	K3
CO4	Write the nomenclature, physical & chemical properties and basic mechanisms of halo organiccompounds and alcohols.	K4
CO5	Investigate the named organic reactions related to phenol; explain the preparation andproperties of aromatic alcohol including thiol.	K5
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: III	Course Code: 23UCHCCP03	Hours/Week: 0+0+3	Credit: 3
COURSE TITLE : CORE COURSE PRACTICAL III - QUALITATIVE INORGANIC ANALYSIS			

Course Overview:

1. This course covers the systematic analysis of simple inorganic salts.
2. These courses generally provide information about the radicals.
3. In this course covers the acid and basic radicals.
4. This course gives knowledge on interfering radicals.

Learning Objectives:

1. To develop the skill on systematic analysis of simple inorganic salts.
2. To give skill on systematic analysis of simple mixture of salts.
3. To understand about radicals.
4. To give the knowledge on interfering radicals.
5. To outline the acid and basic radicals.

Unit - I	Semi - Micro Qualitative Analysis	36 Hours

1. Analysis of simple acid radicals: Carbonate, Sulphide, Sulphate, Chloride, Bromide, Iodide, Nitrate.
2. Analysis of interfering acid radicals: Fluoride, Oxalate, Borate, Phosphate.
3. Elimination of interfering acid radicals and Identifying the group of basic radicals.
4. Analysis of basic radicals (group wise): Lead, Copper, Bismuth, Cadmium, Antimony, Iron, Aluminum, Zinc, Manganese, Nickel, Cobalt, Calcium, Strontium, Barium, Magnesium, Ammonium.
5. Analysis of a mixture - I to VI containing two cations and two anions (of which one is interfering type).

Text Book(s):

1. Kulandaivelu A.R., Veeraswamy R.,Venkateswaran, Basic Principles of Practical Chemistry, Sultan Chand & Sons, 2017.

2. Thomas A.O., Practical Chemistry for B.Sc Chemistry.

Reference Books:

1. V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.

Web Resources:

1. https://www.vlab.co.in/broad-area-chemical-sciences

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:
Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Acquire knowledge on the systematic analysis of Mixture of salts.	K1
CO2	Identify the captions and anions in the unknown substance.	K2
CO3	Identify the captions and anions in the soil and water and to test the quality of water.	K3
CO4	Assess the role of common ion effect and solubility product	K4

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	M	M

S - Strong, M – Medium, L – Low

Semester: III	Course Code: 23UCHSE02	Hours/Week: 1+0+0	Credit: 1
COURSE TITLE : SKILL ENHANCEMENT COURSE II - ENTREPRENEURIAL SKILLS IN CHEMISTRY			

Course Overview:

1. This course covers the entrepreneur skills in students.
2. These courses generally provide the information in food chemistry.
3. In this course covers the start ups.
4. This course gives the knowledge to develop products.

Learning Objectives:

1. To develop entrepreneur skills in students.
2. To provide hands on experience to prepare and develop products.
3. To develop start ups.
4. To familiarizing food chemistry.

Unit - I	Food Chemistry (Internal Examination Only)	06 Hours

Food adulteration - contamination of food items with clay stones, water and toxic chemicals - Common adulterants. Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colorants, Preservatives, leavening agents, Baking powder and baking soda, yeast, MSG, vinegar. Detection of adulterants in food items like coffee, tea, pepper, chili powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques.

Unit - II	Hands on Experience (Students can choose any four) (Internal Examination Only)	06 Hours

Preparation of Jam, squash and Jelly, Gulk and, cottage cheese. Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale. Extraction of oils from spices and flowers. Testing of water samples using testing kit. Dyeing - cotton fabrics with natural and synthetic dyes. Printing - tie and dye, batik.

Text Book(s):

1. George S & Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai.
2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.

Reference Books:

1. Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice), Elsevier, e Book ISBN 9087128004289, 1st Edition, 2015.

Web Resources:

1. https://www.vlab.co.in/broad-area-chemical-sciences

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Identify adulterated food items by doing simple chemical tests.	K1
CO2	Prepare cleaning products and become entrepreneurs.	K2
CO3	Educate others about adulteration and motivate them to become entrepreneurs.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S

S - Strong, M – Medium, L – Low

Semester: III	Course Code: 23UCHSE03	Hours/Week: 2+0+0	Credit: 2
COURSE TITLE : SKILL ENHANCEMENT COURSE III - PESTICIDE CHEMISTRY			

Course Overview:

1. This course covers the eco-friendly pesticides.
2. These courses provide the information in insecticides.
3. In this course covers the biopesticides.
4. This course introduces the pesticides in the form of residues and its analysis

Learning Objectives:

1. To understand the knowledge about the various types of pesticides and their toxicity.
2. To outline the accumulation of pesticides in the form of residues and its analysis.
3. To give the knowledge on choice of alternate and eco-friendly pesticides.
4. To discuss the concept of insecticides.
5. To providing knowledge on biopesticides.

Unit - I	Introduction	05 Hours

History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties.

Toxicity of pesticides

Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of Pesticides.

Unit - II	Insecticides	05 Hours

Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity. Organophosphates and Phosphothionates: Acephate, and parathion-methyl. Organochlorine - Endosulfan,; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.

Unit - III	Pesticides residues:	05 Hours

Introduction- application of agrochemicals, dissemination pathways of pesticides, causes of Pesticide residues, remedies. Pesticides residues in atmosphere - entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water- entry into water systems, action and effect in aquatic environment. Pesticides residues in soil, entry into soil, absorption,.

retention and transport in soil, effects on microorganism, soil condition and fertility, Decomposition and degradation by climatic factors and microorganism.

Unit - IV	Pesticide Residues effect and analysis	05 Hours

Effects of pesticides residue on human life, birds and animals - routes for exposure to pesticides, Action of pesticides on living system. Analysis of pesticides residues- sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.

Unit - V	Biopesticides	04 Hours

Pheromones, attractants, repellents - Introduction, types and application
Trimedlure, Cue-lure, methyl eugenol, Dimethyl phthalate,. Baits - Metaldehyde,
Iron (II) phosphate, Indoxacarb, Zinc Phosphide,

Text Book(s):

1. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012.
2. Matolcsy G, Nádasy M, Andriska V. Pesticide chemistry. Elsevier; 1989.
3. J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press,1985.
4. R. Cremlyn: Pesticides, John Wiley.

Reference Books:

1. Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors PLtd; 1st Ed. (2010).
2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods of pesticide residues analysis. CRC press; 2016.
3. Eller brock R.H., Pesticide Residues: Significance, Management and Analysis, 2005

Web Resources:

1) https://www.mooc-list.com/tags/pesticide

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes: Upon successful completion of this course, the student will be able to		
COs	**Statements**	**Bloom's Level**
CO1	Identify pesticide structures, chemical names, physical and chemical properties.	K1
CO2	Prepare pesticide products and become entrepreneurs.	K2
CO3	Educate others about biopesticides and motivate them to become entrepreneurs.	K3
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S

S - Strong, M – Medium, L - Low