B.Sc., CHEMISTRY

Syllabus

Program Code: UCH

2023 - Onwards

MANNAR THIRUMALAI NAICKER COLLEGE

(AUTONOMOUS)

Re-accredited with "A" Grade by NAAC

PASUMALAI, MADURAI – 625 004

GUIDLINESS FOR OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM

(FOR UG PROGRAM FROM 2023 -2024 ONWARDS)

ELIGIBILITY FOR ADMISSION

Candidates seeking admission to the UG Degree program must have passed the Higher Secondary Education (respective groups – Arts / Science) of the Government of Tamil Nadu or any other state or its equivalent qualification.

DURATION OF THE COURSE

The duration of the course shall be three academic years comprising six semesters with two semesters in each academic year.

Subjects of Study

Part I : Tamil / Hindi /

Part II : English

Part III :

1.Core Subjects
2.Allied Subjects
3.Electives

Part IV:

1.Non Major Electives (I Year)
2.Skill Based Subjects
3.Environmental Studies - Mandatory Subject
4.Value Education - Mandatory Subject

Part V :

Extension Activities

ARTS & SCIENCE

CBCS COURSE STRUCTURE FOR UG PROGRAMS

Sem I	Credit	Sem II	Credit	Sem III	Credit	Sem IV	Credit	Sem V	Credit	Sem VI	Credit
1.1. Language - Tamil	3	2.1. Language - Tamil	3	3.1. Language - Tamil	3	4.1. Language - Tamil	3	5.1 Core Course – \CC IX	4	6.1 Core Course – CC XIII	4
1.2 English	3	2.2 English	3	3.2 English	3	4.2 English	3	5.2 Core Course – CC X	4	6.2 Core Course – CC XIV	4
1.3 Core Course – CC I	4	2.3 Core Course – CC III	4	3.3 Core Course – CC V	4	4.3 Core Course – CC VII Core Industry Module	4	5. 3.Core Course CC -XI	4	6.3 Core Course – CC XV	4
1.4 Core Course – CC II	4	2.4 Core Course – CC IV	4	3.4 Core Course – CC VI	4	4.4 Core Course – CC VIII	4	5. 3.Core Course –/ Project with viva-voce CC - XII	4	6.4 Elective -VII Generic/ Discipline Specific	3
1.5 Elective I Generic/ Discipline Specific	3	2.5 Elective II Generic/ Discipline Specific	3	3.5 Elective III Generic/ Discipline Specific	3	4.5 Elective IV Generic/ Discipline Specific	3	5.4 Elective V Generic/ Discipline Specific	3	6.5 Elective VIII Generic/ Discipline Specific	3
1.6 Skill Enhancement Course SEC-1 (NME)	2	2.6 Skill Enhancement Course SEC-2 (NME)	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	4.6 Skill Enhancement Course SEC-6	2	5.5 Elective VI Generic/ Discipline Specific	3	6.6 Extension Activity	1
1.7Ability Enhancement Compulsory Course (AECC) Soft Skill-1	2	2.7 Skill Enhancement Course – SEC-3(NME)	2	3.7 Skill Enhancement Course SEC-5	2	4.7 Skill Enhancement Course SEC-7	2	5.6 Value Education	2	6.7 Professional Competency Skill	2
1.8 Skill Enhancement - (Foundation Course)	2	2.8 Ability Enhancement Compulsory Course (AECC) Soft Skill-2	2	3.7 Ability Enhancement Compulsory Course (AECC) Soft Skill-3	2	4.7 7Ability Enhancement Compulsory Course (AECC) Soft Skill-4	2	5.5 Summer Internship /Industrial Training	2		
				3.8 E.V.S	-	4.8 E.V.S	2				
	23		**23**		**22**		**25**		**26**		**21**
	Total Credit Points										**140**

QUESTION PAPER PATTERN FOR THE CONTINUOUS INTERNAL ASSESSMENT

Note: Duration – 1 hour

(FOR PART I, PART II & PART III)

The components for continuous internal assessment are:

Part –A

Four multiple choice questions (answer all) 4 x01= 04 Marks

Part –B

Two questions (‘either …. or ‘type) 2 x05= 10 Marks

Part –C

Two questions (‘either …. or ‘type) 2 x 08=16 Marks

Total 30 Marks

THE COMPONENTS FOR CONTINUOUS INTERNAL ASSESSMENT ARE:

(60 Marks of two continuous internal assessments will be converted to 15 marks)

Two tests and their average --15 marks

Seminar /Group discussion / Quiz Test --5 marks

Assignment --5 marks

Total 25 Marks

QUESTION PAPER PATTERN FOR THE SUMMATIVE EXAMINATIONS:

Note: Duration- 3 hours

Part –A

Ten multiple choice questions	10 x01	= 10 Marks

No Unit shall be omitted: not more than two questions from each unit.)

Part –B

Five Paragraph questions (‘either …. or ‘type)	5 x 05	= 25 Marks

(One question from each Unit)

Part –C

Five Paragraph questions (‘either …. or ‘type)	5 x 08	= 40 Marks

(One question from each Unit)

Total	75 Marks

PART-IV- SKILL BASED PAPERS / NME:

The Scheme of Examination for Skill Based Papers: (Except Practical Lab Subjects)

QUESTION PAPER PATTERN FOR THE CONTINUOUS INTERNAL ASSESSMENT (SKILL BASED AND NME COURSES) DURATION – 1 HOUR

- 50 MCQs will be asked for each internal assessment tests (50 x 1=50 Marks) and converted for 15 marks

THE COMPONENTS FOR CONTINUOUS INTERNAL ASSESSMENT ARE:

Two tests and their average	--15 marks
Seminar /Group discussion / Quiz Test	-- 5 marks
Assignment	-- 5 marks
Total	25 Marks

SUMMATIVE EXAMINATION PATTERN (SKILL BASED AND NME COURSES) DURATION – 3 HOURS

Pattern of the Question Paper for Skill Based and Non-Major Elective courses (External)

75 Multiple choice questions will be asked from five units (75 x 1=75 Marks)

(15MCQ's from each unit)

PART-IV- ENVIRONMENTAL STUDIES AND VALUE EDUCATION

QUESTION PAPER PATTERN (INTERNAL ASSESSMENT)

Pattern of the Question Paper for Environmental Studies & Value Education (Internal)

50 MCQs will be asked for each internal assessment tests (50 x 1=50 Marks) and converted for 15 marks

Two tests and their average	--	15 marks
Project	--	10 marks

Total		25 Marks
		---

* The students as Individual or Group must visit a local area to document environmental assets – river / forest / grassland / hill / mountain – visit a local polluted site – urban / rural / industrial / agricultural – study of common plants, insects, birds – study of simple ecosystem – pond, river, hill slopes, etc.

SUMMATIVE EXAMINATION PATTERN

Pattern of the Question Paper for Environmental Studies & Value Education only) (External)

75 Multiple choice questions will be asked from five units (75 x 1=75 Marks)

(15MCQ's from each unit)

PART V EXTENSION ACTIVITIES: (MAXIMUM MARKS: 100)

1. NCC
2. NSS
3. Physical Education
4. YRC
5. RRC
6. Health & Fitness Club
7. Eco Club
8. Human Rights Club

Internal Examinations - - 25 Marks

Summative Examinations - - 75 Marks

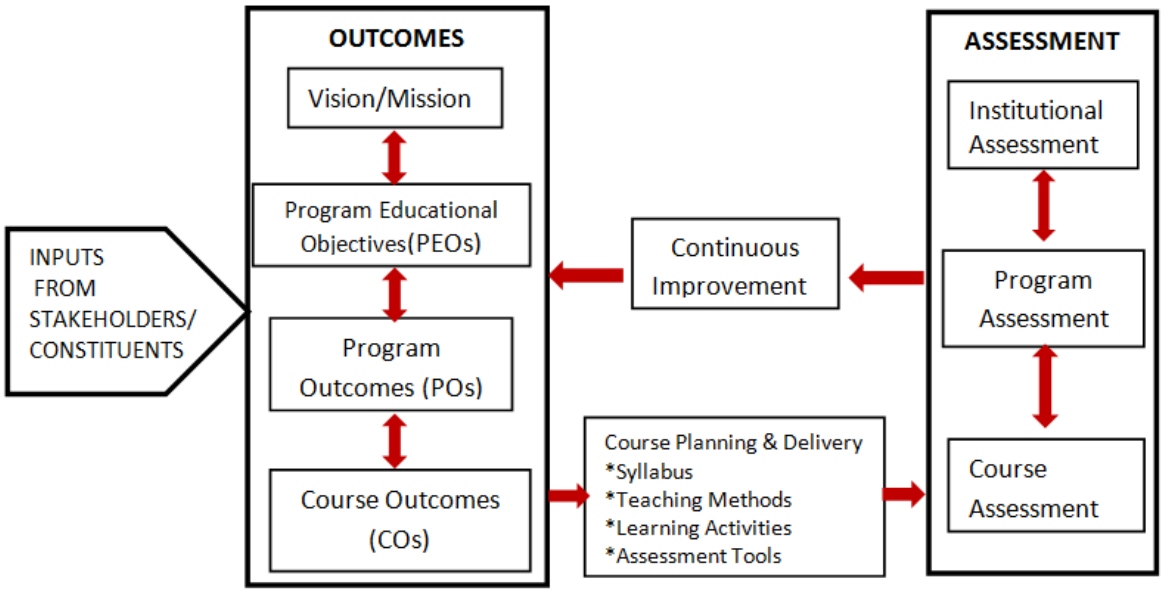
100

OUTCOME BASED EDUCATION:

OBE starts with the identification and articulation of clear and measurable learning outcomes for each course or program. These outcomes describe the skills, knowledge, and abilities that students are expected to acquire. The curriculum, instructional methods, and assessments are aligned with the defined learning outcomes. This ensures that everything taught and evaluated is directly related to what students are expected to learn.

The Learning Outcomes-Based Approach to curriculum planning and transaction in our institution ensures whether the teaching-learning processes are oriented towards enabling students to attain the defined learning outcomes relating to the courses within a programme. The outcome based approach, particularly in the context of undergraduate studies, requires a significant shift from teacher-centric to learner-centric pedagogies and from passive to active/participatory pedagogies.

Assessment Method: The students are assessed with 2 internal examination and the summative examination which includes problem based assignments; practical assignment laboratory reports; observation of practical skills; individual project reports ,case-study reports; team project reports; oral presentations, including seminar presentation; viva voce interviews; computerized adaptive testing; etc. and any other pedagogic approaches as per the context.



INSTITUTIONAL VISION

To Mould the learners into accomplished individuals by providing them with a stimulus for social change through character, confidence and competence.

INSTITUTIONAL MISSION

1. Enlightening the learners on the ethical and environmental issues.

2. Extending holistic training to shape the learners in to committed and competent citizens.

3. Equipping them with soft skills for facing the competitive world.

4. Enriching their employability through career oriented courses.

5. Ensuring accessibility and opportunity to make education affordable to the underprivileged.

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.

- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS),
MADURAI – 625 004
B.SC CHEMISTRY CURRICULUM
(For the student admitted during the academic year 2023-2024 onwards)

Course Code	Title of the Course	Hrs	Credits	Maximum Marks		
				Int	Ext	Total
FIRST SEMESTER						
Part – I	**Tamil / Alternative Course**					
23UTAGT11	தமிழ் இலக்கிய வரலாறு - I	6	3	25	75	100
Part – II	**English**					
23UENGE11	GENERAL ENGLISH - I	6	3	25	75	100
Part - III	**Core Courses**					
23UCHCC11	GENERAL CHEMISTRY - I	5	5	25	75	100
23UCHCP11	QUANTITATIVE INORGANIC ESTIMATION AND INORGANIC PREPARATIONS - PRACTICAL	4	4	25	75	100
Part - III	**Elective Courses**					
23UMTEA11 / 23UMBEA12	ALLIED MATHEMATICS - I / ALLIED BOTANY- I	5	4	25	75	100
Part IV	**Non Major Elective**					
23UCHNM11	ROLE OF CHEMISTRY IN DAILY LIFE	2	2	25	75	100
Part IV	**Foundation Course**					
23UCHFC11	FUNDAMENTALS OF CHEMISTRY	2	2	25	75	100
	Total	30	23	175	525	700
SECOND SEMESTER						
Part – I	**Tamil / Alternative Course**					
23UTAGT21	தமிழ் இலக்கிய வரலாறு – II	6	3	25	75	100
Part – II	**English**					
23UENGE21	GENERAL ENGLISH - II	6	3	25	75	100
Part - III	**Core Courses**					
23UCHCC21	GENERAL CHEMISTRY - II	5	5	25	75	100
23UCHCP21	QUANTITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS - PRACTICAL	4	4	25	75	100
Part - III	**Elective Courses**					
23UMTEA21 / 23UMBEA22	ALLIED MATHEMATICS - II / ALLIED BOTANY- II	5	4	25	75	100
Part IV	**Non Major Elective**					
23UCHNM21	DAIRY CHEMISTRY	2	2	25	75	100
Part IV	**Skill Enhancement course**					
23UCHSC21	COSMETICS AND PERSONAL CARE PRODUCTS	2	2	25	75	100
	Total	30	23	175	525	700

FIRST SEMESTER

Course Name	GENERAL CHEMISTRY - I			
Course Code	23UCHCC11	**L+T**	**P**	**C**
Category	CORE	4+1	-	5

COURSE OBJECTIVES: The course aims at giving an overall view of the

- various atomic models and atomic structure
- wave particle duality of matter
- periodic table, periodicity in properties and its application in explaining the chemical behavior
- nature of chemical bonding, and
- fundamental concepts of organic chemistry

UNIT - I ATOMIC STRUCTURE AND PERIODIC TRENDS 12+3

History of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom;The Franck-Hertz Experiment; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli's exclusion principle and Aufbau principle; Numerical problems involving the core concepts**.**

UNIT - II INTRODUCTION TO QUANTUM MECHANICS & MODERN PERIODIC TABLE 12+3

Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wavefunctions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2.

Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity.

UNIT - III STRUCTURE AND BONDING - I 12+3

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 polarisation – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts.

Covalent bond

Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7. Partial ionic character of covalent bond-dipole moment, application to molecules of the type A_2, AB, AB_2, AB_3, AB_4; percentage ionic character- numerical problems based on calculation of percentage ionic character.

UNIT - IV STRUCTURE AND BONDING - II 12+3

VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, CO_3^{2-}, NO_3- ; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, C_2, O_2, O_2^+, O_2^{2-}, O N_2, NO, HF, CO; magnetic characteristics, comparison of VB and MO theories.

Coordinate bond: Definition, Formation of BF_3, NH_3, NH_4^+, H_3O^+ properties.

Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors.

Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points.

UNIT - V	BASIC CONCEPTS IN ORGANIC CHEMISTRY AND ELECTRONIC EFFECTS	12+3

Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes.

Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; 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, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance.

Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane.

Types of organic reactions- addition, substitution, elimination and rearrangements

Total Lecture & Tutorial Hours	75

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

- **https://onlinecourses.nptel.ac.in**
- **http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm**
- **http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html**
- **https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding**
- **https://www.chemtube3d.com**

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL	
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**								

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.	**K1 to K4**
CO2	classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.	**K1 to K4**
CO3	apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx, Δp electronegativity, percentage ionic character and bond order.	**K1 to K4**
CO4	evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects	**K1 to 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.	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG **M – MEDIUM** **L – LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3

CO 3	**3**	**3**	**3**	**3**	**3**
CO 4	**3**	**3**	**3**	**3**	**3**
CO 5	**3**	**3**	**3**	**3**	**3**
WEIGHTAGE	**15**	**15**	**15**	**15**	**15**
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	History of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H- spectrum;	**6**	**Chalk & talk, ppt**
	Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli's exclusion principle and Aufbau principle;	**5**	**Chalk & talk**
	Numerical problems involving the core concepts**.**	**1**	**Practicing problems**
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion & inquiry**
II	Introduction to Quantum mechanics Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wavefunctions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals - Probability density and significance of Ψ and Ψ^2.	**6**	**Chalk & talk**
	Modern Periodic Table Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity.	**5**	**Chalk & talk, animation videos**
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion**
III	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 polarisation– polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts.	**5**	**Chalk & talk, ppt**
	Covalent bond: Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of	**6**	**Chalk & talk, ppt**

	the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7		
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion & inquiry**
IV	VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, $CO_3$2-, NO_3-; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, C_2, O_2, O_2^+, O_2-, O_2^{2-},N_2, NO, HF, CO; magnetic characteristics, comparison of VB and MO theories	**4**	**Chalk & talk**
	Coordinate bond: Definition, Formation of BF_3, NH_3, NH_4^+, H_3O^+ properties Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors	**4**	**Chalk & talk, ppt**
	Weak Chemical Forces-Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding–Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points.	**4**	**Chalk & talk, animation videos**
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion & inquiry**
V	Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes.	**4**	**Chalk & talk**
	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, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance.	**4**	**Chalk & talk**
	Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane Types of organic reactions- addition, substitution, elimination and rearrangements	**4**	**Chalk & talk, ppt**
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion & inquiry**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	**Cos**	**K Level**	**Section A**		**Section B Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K4**	2	K1	2 (K2,K2)	2(K3,K3)
	CO2	**K1 – K4**	2	K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K4**	2	K1	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K4**	2	K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	**Section A (Multiple Choice Questions)**	**Section B (Either / Or Choice)**	**Section C (Either / Or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	**2**	**-**	**-**	**2**	**3.57**	**25**
	K2	**2**	**10**	**-**	**12**	**21.43**	
	K3	**-**	**10**	**16**	**26**	**46.43**	**46.43**
	K4	**-**	**-**	**16**	**16**	**28.57**	**28.57**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**
CIA II	**K1**	**2**	**-**	**-**	**2**	**3.57**	**25**
	K2	**2**	**10**	**-**	**12**	**21.43**	
	K3	**-**	**10**	**16**	**26**	**46.43**	**46.43**
	K4	**-**	**-**	**16**	**16**	**28.57**	**28.57**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1-K4	2	K1&K2	2 (K2)	2 (K3)
2	CO2	K1-K4	2	K1&K2	2 (K3)	2 (K4)
3	CO3	K1-K4	2	K1&K2	2 (K2)	2 (K3)
4	CO4	K1-K4	2	K1&K2	2 (K3)	2 (K4)
5	CO5	K1-K4	2	K1&K2	2 (K4)	2 (K3)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.57	21.43
K2	5	20	-	25	17.86	
K3	-	20	48	68	48.57	48.57
K4	-	10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions				**PART – A**	**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K4**	
		OR		
15. b)	**Unit - V**	**CO5**	**K4**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K3**	
		OR		
20. b)	**Unit - V**	**CO5**	**K3**	

Course Name	QUANTITATIVE INORGANIC ESTIMATION AND INORGANIC PREPARATIONS - PRACTICAL			
Course Code	23UCHCP11	**L**	**P**	**C**
Category	CORE	-	4	4

COURSE OBJECTIVES:

This course aims at providing knowledge on

- laboratory safety
- handling glasswares
- Quantitative estimation
- preparation of inorganic compounds

UNIT - I CHEMICAL LABORATORY SAFETY IN ACADEMIC INSTITUTIONS 5

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 Experiments - I	35
Quantitative Estimation(Volumetric) Preparation of standard solution, dilution from stock solution **Permanganometry** Estimation of sodium oxalate using standard ferrous ammonium sulphate. **Dichrometry** Estimation of ferric alum using standard dichromate (external indicator) Estimation of ferric alum using standard dichromate (internal indicator) **Iodometry** Estimation of copper in copper sulphate using standard dichromate . **Argentimetry** Estimation of chloride in barium chloride using standard sodium chloride/ Estimation of chloride in sodium chloride (Volhard's method)	
UNIT - III Experiments - II	**20**
Complexometry Estimation of hardness of water using EDTA. **Estimations** Estimation of iron in iron tablets Estimation of ascorbic acid. **Preparation of Inorganic compounds** Potash alum Tetraammine copper (II) sulphate Hexamminecobalt (III) chloride Mohr's Salt	
Total Lecture Hours	**60**

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

- Vogel's Textbook of Quantitative Chemical Analysis, 6th ed.; Pearson Education Ltd: New Delhi, 2000.

WEB RESOURCES:

- **http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis**
- **https://chemdictionary.org/titration-indicator/**

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL	
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Explain the basic principles involved in titrimetric analysis and inorganic preparations.	**K1 to K4**
CO2	Compare the methodologies of different titrimetric analysis.	**K1 to K4**
CO3	calculate the concentrations of unknown solutions in different ways	**K1 to K4**
CO4	Develop the skill to estimate the amount of a substance present in a given solution.	**K1 to K4**
CO5	Assess the yield of different inorganic preparations and identify the end point of various titrations.	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:					
COS	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**3**	**3**	**3**	**3**	**3**
CO 2	**3**	**3**	**3**	**3**	**3**
CO 3	**3**	**3**	**3**	**3**	**3**
CO 4	**3**	**3**	**3**	**3**	**3**
CO 5	**3**	**3**	**3**	**3**	**3**
WEIGHTAGE	**15**	**15**	**15**	**15**	**15**
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	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.	**5**	**Explanation with models, chalk & talk**

II	**Quantitative Estimation(Volumetric)** Preparation of standard solution, dilution from stock solution **Permanganometry** Estimation of sodium oxalate using standard ferrous ammonium sulphate **Dichrometry** Estimation of ferric alum using standard dichromate (external indicator) Estimation of ferric alum using standard dichromate (internal indicator) **Iodometry** Estimation of copper in copper sulphate using standard dichromate **Argentimetry** Estimation of chloride in barium chloride using standard sodium chloride/ Estimation of chloride in sodium chloride (Volhard's method)	**35**	**Practical experiments**
III	**Complexometry** Estimation of hardness of water using EDTA **Estimations** Estimation of iron in iron tablets Estimation of ascorbic acid **Preparation of Inorganic compounds** Potash alum Tetraammine copper (II) sulphate Hexamminecobalt (III) chloride Mohr's Salt	**20**	**Practical experiments**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	**Cos**	**K Level**	**Section A**		**Section B**	**Section C**
			MCQs			
			No. of. Questions	**K - Level**		
Model Exam	**CO1**	**K1 – K4**	5	K1		
	CO2	**K1 – K4**	5	K2		
	CO3	**K1 – K4**				1(K4)
	CO4	**K1 – K4**				1 (K3)
	CO5	**K1- K4**			1 (K3)	
Question Pattern Model exam		**No. of Questions to be asked**	10		1	2
		No. of Questions to be answered	10		1	2
		Marks for each question	1		10	10
		Total Marks for each section	10		10	20

Overall CIA marks (25) = (Model exam conducted for 40 marks is converted to 15 marks + regular class observation 10 marks)

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	**COs**	**K - Level**	**Section A (MCQs)**		**Section B K - LEVEL**	**Section C K - LEVEL**
			No. of Questions	**K – Level**		
1	**CO1**	**K1 – K4**	5	K1		
2	**CO2**	**K1 – K4**	5	K2		
3	**CO3**	**K1 – K4**				1(K4)
4	**CO4**	**K1 – K4**				1(K3)
5	**CO5**	**K1 – K4**			1 (K3)	
No. of Questions to be Asked			10		1	2
No. of Questions to be answered			10		1	2
Marks for each question			1		10	15
Total Marks for each section			10		10	30
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Overall Summative Exam marks (75) = Exam marks (60) + Record marks (15)

Course Name	ALLIED MATHEMATICS - I			
Course Code	23UMTEA11	**L**	**P**	**C**
Category	ELECTIVE	5	-	4

COURSE OBJECTIVES:

- To explore the fundamental concepts of Mathematics.
- To acquire knowledge about finding approximate roots of the polynomial equations.
- To improve students' ability in applications of matrices and calculus.
- Students are exposed to understanding the concept of derivatives and their applications.
- To expose double and triple integrals and their applications

UNIT – I SOLUTIONS OF TRANSCENDENTAL AND ALGEBRAIC EQUATIONS 15

Iteration method, Bisection method, Newton's method – Regula Falsi method, Horner's method(without proof) (Simple problems only

UNIT – II SOLUTIONS OF SIMULTANEOUS EQUATIONS 15

Gauss Elimination method - Gauss Jordan method – Gauss Seidel Iterative method - Gauss Jacobi method (Restricted to three variables only) (Simple problems only)

UNIT - III MATRICES 15

Characteristic equation of a square matrix– Eigen values and eigen vectors – Cayley – Hamilton theorem [without proof] – Verification and computation of inverse matrix

UNIT – IV DIFFERENTIAL CALCULUS 15

n-th derivatives – Leibnitz theorem [without proof] and applications – Jacobians– Curvature and radius of curvature in Cartesian co-ordinates and polar co-ordinates

UNIT - V APPLICATION OF INTEGRATION 15

Evaluation of double, triple integrals – Simple applications to area, volume, and centroid.

Total Lecture Hours 75

BOOKS FOR STUDY:

- P.Kandasamy, K.Thilagavathy (2003) Calculus of Finite differences
- Numerical Analysis, S. Chand & Company Ltd., New Delhi-55
  Unit I : Chapter 1

  Unit II: Chapter 2
- P. Duraipandian and Dr. S. Udayabaskaran (1997), "Allied Mathematics" , Vol I

  Chennai: Muhil Publishers.
  Unit III: Chapter 1 - Sec – 1.1.1, 1.1.2, 1.2, 1.4.3

- P. Duraipandian and Dr. S. Udayabaskaran (1997), "Allied Mathematics" , Vol II. Chennai: Muhil Publishers.

Unit IV : Chapter 1 - Sec – 1.1.1,1.1.2,1.2,1.4.3

Unit V: Chapter 3 – Sec - 3.4, 3.4.1, 3.5.1, 3.5.2, 3.6

BOOKS FOR REFERENCES:

- S.J.Venkatesan, "Allied Mathematics - I", Sri Krishna Publications, Chennai.
- P. R. Vittal (2003), "Allied Mathematics", Margham Publication, Chennai
- A.Singaravelu "Numerical Methods"Meenakshi Publications

WEB RESOURCES:

- **https;//www.mathwarehous.com/**
- **https;//www.mathhelp.com/**
- **https;//www.mathsisfun.com/**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL	✓	NATIONAL		GLOBAL	
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Find out the approximate roots of polynomial equations.	K1 to K4
CO2	Develop the skills of finding roots of simultaneous equations	K1 to K4
CO3	Demonstrate knowledge about matrices and their applications	K1 to K4
CO4	Carry out calculations of problems related to curvature and radius of curvature.	K1 to K4
CO5	Evaluate double and triple integrals, and enabled to understand the applications of integration in real-life situation	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	2	3	3				
CO2	2	1	2	2	2	2				
CO3	3	2	2	3	1	2				
CO4	2	2	2	2	2	2				
CO5	2	1	2	2	3	2				

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:

UNIT	ALLIED MATHEMATICS – I	HRS	PEDAGOGY
I	Iteration method, Bisection method, Newton's method – Regula Falsi method, Horner's method(without proof) (Simple problems only	15	Chalk & Talk
II	Gauss Elimination method - Gauss Jordan method – Gauss Seidel Iterative method - Gauss Jacobi method (Restricted to three variables only) (Simple problems only)	15	Chalk & Talk
III	Characteristic equation of a square matrix– Eigen values and eigen vectors – Cayley – Hamilton theorem [without proof] – Verification and computation of inverse matrix	15	Chalk & Talk

IV	n-th derivatives – Leibnitz theorem [without proof] and applications – Jacobians- Curvature and radius of curvature in Cartesian co-ordinates and polar co-ordinates	**15**	**Chalk & Talk**
V	Evaluation of double, triple integrals – Simple applications to area, volume, and centroid.	**15**	**Chalk & Talk**

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	CO3	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II

	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2	10		2	3.6	
	K3		10	16	26	46.4	46.4
	K4			16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5			5	3.6	4
K2	5	20		25	17.8	18
K3		30	32	62	44.3	44
K4			48	48	34.3	34
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions				**PART – A**	**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	ALLIED BOTANY - I			
Course Code	23UMBEA12	**L**	**P**	**C**
Category	ALLIED	5	-	4

COURSE OBJECTIVES:

- To study morphological and anatomical adaptations of plants of various habitats.
- To demonstrate techniques of plant tissue culture.
- To familiarize with the structure of DNA, RNA.
- To carryout experiments related with plant physiology.
- To perform biochemistry experiments.

UNIT - I Algae **12**

General characters of algae - Structure, reproduction and life cycle of the following genera - *Anabaena* and *Sargassum* and economic importance of algae.

UNIT - II Fungi, Bacteria and Virus **12**

General characters of fungi, structure, reproduction and life cycle of the following genera - *Penicillium* and *Agaricus* and economic importance of fungi.
Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria.
Virus - general characters, structure of TMV, structure of bacteriophage.

UNIT - III Bryophytes, Pteridophytes and Gymnosperms **12**

General characters of Bryophytes, Structure and life cycle of *Funaria*.
General characters of Pteridophytes, Structure and life cycle of *Lycopodium*.
General characters of Gymnosperms, Structure and life cycle of *Cycas*.

UNIT - IV Cell Biology **12**

Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.

UNIT - V Genetics and Plant Biotechnology **12**

Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law ofindependent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods. Plant tissue culture and its application in biotechnology.

Total Lecture Hours **60**

BOOKS FOR STUDY:

- Singh,V.,Pande,P.C andJain,D.K. 2021. ATextBookofBotany.RastogiPublications,Meerut.
- Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
- Sharma,O.P.2017. Bryophyta, MacMillanIndiaLtd.Delhi.
- Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
- Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt. Ltd., Madras.

BOOKS FOR REFERENCES:

- Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.
- Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
- Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
- Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
- Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
- Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.
- Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II, S.Chand and Co. New Delhi.

WEB RESOURCES:

- **https://www.kobo.com/us/en/ebook/the-algae-world**
- **http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html**
- **http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm**
- **https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/**
- **https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf**
- **https://www.us.elsevierhealth.com/medicine/cell-biology**
- **https://www.us.elsevierhealth.com/medicine/genetics**
- **https://www.kobo.com/us/en/ebook/plant-biotechnology-1**

Nature of Course	EMPLOYABILITY			SKILL ORIENTED	✓		ENTREPRENEURSHIP				
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL			GLOBAL	✓		
Changes Made in the Course	Percentage of Change			No Changes Made			New Course	✓			
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**											

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Increase the awareness and appreciation of human friendly algae and their economic importance.	**K1 to K4**
CO2	Develop an understanding of microbes and fungi and appreciate their adaptive strategies.	**K1 to K4**
CO3	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	**K1 to K4**
CO4	Compare the structure and function of cells and explain the development of cells.	**K1 to K4**
CO5	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3					
CO2	3	3	3	3	3					
CO3	2	3	3	3	3					
CO4	3	3	2	3	3					
CO5	3	2	2	2	2					
S- STRONG				M – MEDIUM				L - LOW		

CO / PO MAPPING:					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	1	3	3	3	3
CO 4	3	2	3	2	3
CO 5	2	2	1	2	1
WEITAGE	12	13	13	13	13
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS					

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	**Algae:** General characters of algae - Structure, reproduction and life cycle of the following genera - *Anabaena* and *Sargassum* and economic importance of algae.	12	PPT/CHALK AND TALK
II	**Fungi, Bacteria and Virus:**General characters of fungi, structure, reproduction and life cycle of the following genera - *Penicillium* and *Agaricus* and economic importance of fungi. Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage.	12	PPT/CHALK AND TALK
III	**Bryophytes, Pteridophytes and Gymnosperms:**General characters of Bryophytes, Structure and life cycle of *Funaria*. General characters of Pteridophytes, Structure and life cycle of *Lycopodium*. General characters of Gymnosperms, Structure and life cycle of *Cycas*	12	PPT/CHALK AND TALK
IV	**Cell Biology:** Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles	12	PPT/CHALK AND TALK

	- ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.		
V	**Genetics and Plant Biotechnology:** Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law ofindependent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods. Plant tissue culture and its application in biotechnology.	**12**	**PPT/CHALK AND TALK**

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	CO3	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II

	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2	10		2	3.6	
	K3		10	16	26	46.4	46.4
	K4			16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5			5	3.6	4
K2	5	20		25	17.8	18
K3		30	32	62	44.3	44
K4			48	48	34.3	34
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions				**PART – A**	**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	ROLE OF CHEMISTRY IN DAILY LIFE			
Course Code	23UCHNM11	**L**	**P**	**C**
Category	NON-MAJOR ELECTIVE	2	-	2

COURSE OBJECTIVES: This course aims at providing knowledge on

- importance of Chemistry in everyday life
- chemistry of building materials and food
- chemistry of Drugs and pharmaceuticals

UNIT - I CHEMICALS IN NATURE **06**

General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution

UNIT - II BUILDING MATERIALS & PLASTICS **06**

Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and uses only.

UNIT - III FOOD & NUTRITION , COSMETICS **06**

Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins (sources and their physiological importance).

Cosmetics – tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes - general formulation and preparations - possible hazards of cosmetic use.

UNIT - IV CHEMICALS IN FOOD PRODUCTION & FUELS **06**

Chemicals in food production – fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate.

Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses.

UNIT - V PHARMACEUTICALS, DYES & EXPLOSIVES **06**

Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications.

Explosives - classification and examples.

Total Lecture Hours	**30**

BOOKS FOR STUDY:

- Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
- A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012.
- S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
- B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
- Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019.
- Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006

BOOKS FOR REFERENCES:

- Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourthedition, 1977.
- W.A.Poucher, JosephA.Brink, Jr.Perfumes, Cosmetics and Soaps, Springer, 2000.
- A.K.De, Environmental Chemistry, NewAge International PublicCo., 1990.

WEB RESOURCES:

- **https://www.science.org.au/curious/chemistry**
- **https://www.nsf.gov/news/classroom/chemistry.jsp**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED		ENTREPRENEURSHIP	✓		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL	
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Identify the chemicals used in everyday life as well as air pollution and water pollution.	**K1 to K2**
CO2	Describe on building materials cement, ceramics, glass and plastics, polythene, PVC bakelite, polyesters,	**K1 to K2**
CO3	Summarize on Food and Nutrition. Carbohydrates, Proteins, Fats Also have an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.	**K1 to K2**
CO4	Discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses	**K1 to K2**
CO5	illustrate the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.	**K1 to K2**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M

CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style.	3	Chalk & talk, ppt
	Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution	3	Chalk & talk
II	Building materials - cement, ceramics, glass and refractories - definition, composition and application only.	3	Chalk & talk
	Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and uses only.	3	Chalk & talk,ppt
III	Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins (sources and their physiological importance).	3	Chalk & talk

	Cosmetics – tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes - general formulation and preparations - possible hazards of cosmetic use.	3	**Chalk & talk, ppt**
IV	Chemicals in food production – fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate.	3	**Chalk & talk, ppt**
	Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses.	3	**Chalk & talk, ppt**
V	Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin.	3	**Chalk & talk, ppt**
	Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.	3	**Chalk & talk, ppt**

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A	
			MCQs	
			No. of. Questions	K - Level
CI AI	CO1	K1 – K2	25	K1,K2
	CO2	K1 – K2	25	K1,K2
CI AII	CO3	K1 – K2	25	K1,K2
	CO4	K1 – K2	25	K1,K2
Question Pattern CIA I & II		No. of Questions to be asked	50	
		No. of Questions to be answered	50	
		Marks for each question	1	
		Total Marks for each section	50	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (I^{st} Test-2 CO's & II^{nd} Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	Section A (Multiple Choice Questions)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100
CIA II	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	COs	K - Level	Section A (MCQs)	
			No. of Questions	K – Level
1	CO1	K1-K2	15	K1,K2
2	CO2	K1-K2	15	K1,K2
3	CO3	K1-K2	15	K1,K2
4	CO4	K1-K2	15	K1,K2
5	CO5	K1-K2	15	K1,K2
No. of Questions to be Asked			75	
No. of Questions to be answered			75	
Marks for each question			1	
Total Marks for each section			75	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**40**	**40**	**53**	**100**
K2	**35**	**35**	**47**	
K3				
K4				
Marks		**75**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				

Course Name	FUNDAMENTALS OF CHEMISTRY			
Course Code	23UCHFC11	**L**	**P**	**C**
Category	SKILL ENHANCEMENT COURSE	2	-	2

COURSE OBJECTIVES: This course aims

- To help students to get an overview of chemistry before learning their core courses.
- To serve as a bridge between the school curriculum and the degree programme.

UNIT - I Chemicals in nature **06**

General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution.

UNIT - II Basic concepts in Chemistry **06**

Importance of Chemistry- Nature of Matter- Properties of matter- Uncertainty in measurement- laws of chemical combinations – Dalton's atomic theory – atomic and molecular masses- mole concept and molar masses- percentage composition- stoichiometry and stoichiometric calculations.

Structure of atom – sub atomic particles – atomic models – Bohr's atomic model of hydrogen atom- Quantum mechanical model of atom.

UNIT - III State of Matter and Thermodynamics **06**

Intermolecular forces- thermal energy- the gaseous state – the gas laws- ideal gas equation – kinetic molecular theory of gases – deviation of real gases from ideal gas behaviour – liquefaction of gases – liquid state.

Thermodynamic state- applications – measurement of ΔU and ΔH: calorimetry- enthalpy change ΔH of a reaction – enthalpies for different types of reactions – spontaneity – Gibbs energy change and equilibrium.

UNIT - IV Organic chemistry – Basic principles and techniques **06**

Tetravalence of Carbon: Shapes of Organic compounds – structural representation- classification – nomenclature – isomerism- fundamental concepts in organic mechanism- methods of purification of organic compounds – qualitative analysis of organic compounds – quantitative analysis

Hydrocarbons- Classification – alkanes – alkenes- alkynes – aromatic hydrocarbon- carcinogenicity and toxicity.

UNIT - V	Elementary ideas on Biomolecules	06
Carbohydrates- classification- monosaccharides – glucose and fructose – structure – disaccharides – polysaccharides- importance Aminoacids – classification – structure of proteins- denaturation. Vitamins – classification. Nucleic acids – chemical composition- structure – biological function		
	Total Lecture Hours	**30**

BOOKS FOR STUDY:

- NCERT Class XI and class XII Chemistry books

BOOKS FOR REFERENCES:

- TN school text book class XI and XII

WEB RESOURCES:

- **https://ncert.nic.in/textbook.php**
- **https://tntextbooks.online/**
- **https://www.youtube.com/c/ncertofficial/videos**

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP						
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓			
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓					

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Identify the chemicals used in everyday life as well as air pollution and water pollution.	K1 to K2
CO2	Summarize Basic concepts of chemistry	K1 to K2
CO3	Describe state of matter and thermodynamics	K1 to K2
CO4	Illustrate basic principles and techniques Organic chemistry	K1 to K2
CO5	Explain elementary ideas on Biomolecules	K1 to K2

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style.	3	Chalk & talk, ppt
	Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution.	3	Chalk & talk

II	Importance of Chemistry- Nature of Matter- Properties of matter- Uncertainty in measurement- laws of chemical combinations – Dalton's atomic theory – atomic and molecular masses- mole concept and molar masses- percentage composition- stoichiometry and stoichiometric calculations.	**4**	**Chalk & talk, problem solving**
	Structure of atom – sub atomic particles – atomic models – Bohr's atomic model of hydrogen atom- Quantum mechanical model of atom.	**2**	**Chalk & talk**
III	Intermolecular forces- thermal energy- the gaseous state – the gas laws- ideal gas equation – kinetic molecular theory of gases – deviation of real gases from ideal gas behaviour – liquefaction of gases – liquid state.	**3**	**Chalk & talk**
	Thermodynamic state- applications – measurement of ΔU and ΔH: calorimetry- enthalpy change ΔH of a reaction – enthalpies for different types of reactions – spontaneity – Gibbs energy change and equilibrium	**3**	**Chalk & talk**
IV	Tetravalence of Carbon: Shapes of Organic compounds – structural representation- classification – nomenclature – isomerism- fundamental concepts in organic mechanism- methods of purification of organic compounds – qualitative analysis of organic compounds – quantitative analysis	**4**	**Chalk & talk, animation videos**
	Hydrocarbons- Classification – alkanes – alkenes- alkynes – aromatic hydrocarbon- carcinogenicity and toxicity.	**2**	**Chalk & talk**
V	Carbohydrates- classification- monosaccharides – glucose and fructose – structure – disaccharides – polysaccharides- importance.	**3**	**Chalk & talk**
	Aminoacids – classification – structure of proteins- denaturation. Vitamins – classification. Nucleic acids – chemical composition- structure – biological function	**3**	**Chalk & talk, ppt**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	**Cos**	**K Level**	**Section A**	
			MCQs	
			No. of. Questions	**K - Level**
CI AI	**CO1**	**K1 – K2**	**25**	**K1,K2**
	CO2	**K1 – K2**	**25**	**K1,K2**
CI AII	**CO3**	**K1 – K2**	**25**	**K1,K2**
	CO4	**K1 – K2**	**25**	**K1,K2**
Question Pattern CIA I & II		**No. of Questions to be asked**	**50**	
		No. of Questions to be answered	**50**	
		Marks for each question	**1**	
		Total Marks for each section	**50**	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (Ist Test-2 CO's & IInd Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	**30**	**30**	**60**	**100**
	K2	**20**	**20**	**40**	
	K3				
	K4				
	Marks	**50**	**50**	**100**	**100**
CIA II	**K1**	**30**	**30**	**60**	**100**
	K2	**20**	**20**	**40**	
	K3				
	K4				
	Marks	**50**	**50**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	**COs**	**K - Level**	**Section A (MCQs)**	
			No. of Questions	**K – Level**
1	**CO1**	**K1-K2**	**15**	**K1,K2**
2	**CO2**	**K1-K2**	**15**	**K1,K2**
3	**CO3**	**K1-K2**	**15**	**K1,K2**
4	**CO4**	**K1-K2**	**15**	**K1,K2**
5	**CO5**	**K1-K2**	**15**	**K1,K2**
No. of Questions to be Asked			**75**	
No. of Questions to be answered			**75**	
Marks for each question			**1**	
Total Marks for each section			**75**	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**40**	**40**	**53**	**100**
K2	**35**	**35**	**47**	
K3				
K4				
Marks		**75**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				

SECOND SEMESTER

Course Name	GENERAL CHEMISTRY - II			
Course Code	23UCHCC21	**L+T**	**P**	**C**
Category	CORE	4+1	-	5

COURSE OBJECTIVES:

This course aims to provide a comprehensive knowledge on

- chemistry of acids, bases and ionic equilibrium
- properties of s and p-block elements
- chemistry of hydrocarbons
- applications of acids and bases
- compounds of main block elements and hydrocarbons

UNIT - I ACIDS, BASES AND IONIC EQUILIBRIA 12+3

Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, 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-Hasselbalch equation; Acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves (4 types) - use of acid base indicators.

UNIT - II CHEMISTRY OF s - BLOCK & p- BLOCK ELEMENTS (13-14) 12+3

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, properties and uses of NaOH, $KClO_3$ alkaline earth metals – general properties alone. Anomalous behaviour of Be.

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

Preparation and structure and bonding of diborane and borazine. Extraction of Al and its uses. Alloys of Al.

Comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Silane- Silicone polymers- synthesis and applications.

UNIT - III CHEMISTRY OF p- BLOCK ELEMENTS (GROUP 15-18) 12+3

General characteristics of elements of Group 15; chemistry of $H_2N\text{-}NH_2$, NH_3 and urea. Chemistry of P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4), DAP and Super phosphate- preparation and uses.

General properties of elements of group16 - Classification and properties of oxides - chemistry of ozone- allotropes of Sulphur- - oxides of sulphur (SO_2 & SO_3) – Oxy acids of sulphur (Sulphuric acid ,Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Preparation of Fluorine and difficulties in preparation of Fluorine, Peculiarities of fluorine. Bleaching powder – preparation, properties and uses. Inter-halogen compounds (Types and structure alone), pseudo halogens [$(CN)_2$ and $(SCN)_2$].

UNIT - IV HYDROCARBON CHEMISTRY-I	12+3

Alkenes-Nomenclature, general methods of preparation – Mechanism of β- elimination reactions – E_1 and E_2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis, polymerisation.

Alkynes

Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation.

Cycloalkanes: Nomenclature, Conformational analysis of cyclohexane, Bayer's strain theory and its limitations

UNIT - V HYDROCARBON CHEMISTRY - II	12+3

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. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity.

Polynuclear Aromatic hydrocarbons: Naphthalene and Anthracene -structure, preferential substitution position and uses.

Total Lecture Hours	**75**

BOOKS FOR STUDY:

- B.R. Puri, L.R. Sharma, M.S. Pathania; *Principles of Physical Chemistry*, 46th edition, Vishal Publishing, 2020.
- B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.
- P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & amp; Sons, twentieth edition, 2006.

- M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.
- S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

MOOC components

- **https://nptel.ac.in/courses/104104101**
- **Solid state chemistry https://nptel.ac.in/courses/103106071**
- **Nuclear industries and safety https://nptel.ac.in/courses/104106119s**

Introduction to organic chemistry

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Explain the kinetic properties of gases by using mathematical concepts.	K1 to K4
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 determinations.	K1 to K4
CO3	Investigate the radioactivity, nuclear energy and its production, also the nuclear waste management.	K1 to K4
CO4	Write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.	K1 to K4
CO5	Investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including Thiel.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of	6	Chalk & talk, ppt

	dissociation;		
	Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation; Acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves (4 types) - use of acid base indicators.	**6**	**Chalk & talk, animation videos**
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion & inquiry**
II	**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, properties and uses of NaOH, $KClO_3$ alkaline earth metals – general properties alone. Anomalous behaviour of Be.	**6**	**Chalk & talk**
	Chemistry of p- Block Elements (Group 13 & 14) Preparation and structure and bonding of diborane and borazine. Extraction of Al and its uses. Alloys of Al. Comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Silane- Silicone polymers- synthesis and applications.	**6**	**Chalk & talk, ppt**
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion & inquiry**
III	General characteristics of elements of Group 15; chemistry of $H_2N\text{-}NH_2$, NH_3 and urea. Chemistry of P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4), DAP and Super phosphate- preparation and uses. General properties of elements of group16 - Classification and properties of oxides - chemistry of ozone- allotropes of Sulphur- - oxides of sulphur (SO_2 & SO_3) – Oxy acids of sulphur (Sulphuric acid ,Caro's and Marshall's acids).	**6**	**Chalk & talk**
	Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Preparation of Fluorine and difficulties in preparation of Fluorine, Peculiarities of fluorine. Bleaching powder – preparation, properties and uses. Inter-halogen compounds (Types and structure alone), pseudo halogens [$(CN)_2$ and $(SCN)_2$].	**6**	**Chalk & talk, ppt**
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion**

			& inquiry
IV	**Alkenes**-Nomenclature, general methods of preparation – Mechanism of β- elimination reactions – E_1 and E_2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis, polymerisation.	**6**	**Chalk & talk, model making**
	Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation. **Cycloalkanes:** Nomenclature, Conformational analysis of cyclohexane, Bayer's strain theory and its limitations	**6**	**Chalk & talk, model making**
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion & inquiry**
V	**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,	**6**	**Chalk & talk, model making**
	Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity. **Polynuclear Aromatic hydrocarbons**: Naphthalene and Anthracene -structure, preferential substitution position and uses.	**6**	**Chalk & talk**
	Discussion on Questions related to the above topics, from various competitive examinations	**3**	**Group discussion & inquiry**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	**Cos**	**K Level**	**Section A**		**Section B Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K4**	2	K1	2 (K2,K2)	2(K3,K3)
	CO2	**K1 – K4**	2	K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K4**	2	K1	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K4**	2	K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	**Section A (Multiple Choice Questions)**	**Section B (Either / Or Choice)**	**Section C (Either / Or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	**2**	**-**	**-**	**2**	**3.57**	**25**
	K2	**2**	**10**	**-**	**12**	**21.43**	
	K3	**-**	**10**	**16**	**26**	**46.43**	**46.43**
	K4	**-**	**-**	**16**	**16**	**28.57**	**28.57**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**
CIA II	**K1**	**2**	**-**	**-**	**2**	**3.57**	**25**
	K2	**2**	**10**	**-**	**12**	**21.43**	
	K3	**-**	**10**	**16**	**26**	**46.43**	**46.43**
	K4	**-**	**-**	**16**	**16**	**28.57**	**28.57**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1-K4	2	K1&K2	2 (K2)	2 (K3)
2	CO2	K1-K4	2	K1&K2	2 (K3)	2 (K4)
3	CO3	K1-K4	2	K1&K2	2 (K2)	2 (K3)
4	CO4	K1-K4	2	K1&K2	2 (K3)	2 (K4)
5	CO5	K1-K4	2	K1&K2	2 (K4)	2 (K3)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.57	21.43
K2	5	20	-	25	17.86	
K3	-	20	48	68	48.57	48.57
K4	-	10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K4**	
		OR		
15. b)	**Unit - V**	**CO5**	**K4**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K3**	
		OR		
20. b)	**Unit - V**	**CO5**	**K3**	

Course Name	QUANTITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS - PRACTICAL			
Course Code	23UCHCP21	**L**	**P**	**C**
Category	CORE	-	4	4

COURSE OBJECTIVES:

This course aims at providing knowledge on

- laboratory safety
- handling glass wares
- analysis of organic compounds
- preparation of organic compounds

UNIT - I **02**

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 **29**

Qualitative Organic Analysis

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, polyhydric phenol
- aldehyde, ketone, ester
- carbohydrate (reducing and non-reducing sugars)
- primary, secondary, tertiary amine
- monoamide, diamide, thioamide
- anilide, nitro compound
- Preparation of derivatives for functional groups

UNIT - III **29**

Preparation of Organic Compounds

- Nitration - picric acid from Phenol
- Halogenation - p-bromo acetanilide from acetanilide
- Oxidation - benzoic acid from Benzaldehyde
- Microwave assisted reactions in water:
- Methyl benzoate to Benzoic acid
- Salicylic acid from Methyl Salicylate
- Rearrangement - Benzil to Benzilic Acid

Hydrolysis of benzamide to Benzoic Acid

Separation and Purification Techniques (Not for Examination)

- Purification of organic compounds by crystallization (from water / alcohol) and distillation
- Determination of melting and boiling points of organic compounds.

Steam distillation - Extraction of essential oil from citrus fruits/eucalyptus leaves.

Chromatography (any one) (Group experiment)

Separation of amino acids by Paper Chromatography

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

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

Electrophoresis – Separation of amino acids and proteins. **(Demonstration)**

Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5& 6–not for ESE)

Total Lecture Hours	**60**

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**								

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Observe the physical state, odour, colour and solubility of the given organic compound.	**K1 to K4**
CO2	Identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.	**K1 to K4**
CO3	compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides,	**K1 to K4**
CO4	Differentiate mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.	**K1 to K4**
CO5	exhibit a solid derivative with respect to the identified functional group.	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:			
UNIT	**Qualitative Organic Analysis and Preparation of Organic Compounds**	**HRS**	**PEDAGOGY**
I	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	**02**	**Explanation with models**
II	**Qualitative Organic Analysis** 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, polyhydric phenol ➢ aldehyde, ketone, ester ➢ carbohydrate (reducing and non-reducing sugars) ➢ primary, secondary, tertiary amine ➢ monoamide, diamide, thioamide ➢ anilide, nitro compound ➢ Preparation of derivatives for functional groups	**29**	**Experiments**
III	**Preparation of Organic Compounds** ➢ Nitration - picric acid from Phenol ➢ Halogenation - p-bromo acetanilide from acetanilide ➢ Oxidation - benzoic acid from Benzaldehyde ➢ Microwave assisted reactions in water: ➢ Methyl benzoate to Benzoic acid ➢ Salicylic acid from Methyl Salicylate ➢ Rearrangement - Benzil to Benzilic Acid ➢ Hydrolysis of benzamide to Benzoic Acid **Separation and Purification Techniques (Not for Examination)** ➢ Purificationof organic compounds by crystallization (from water / alcohol) and distillation ➢ Determination of melting and boiling points of organic	**29**	**Experiments**

	compounds. **Steam distillation** - Extraction of essential oil from citrus fruits/eucalyptus leaves. **Chromatography (any one) (Group experiment)** Separation of amino acids by Paper Chromatography Thin Layer Chromatography - mixture of sugars / plant pigments /permanganate dichromate. Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate. **Electrophoresis –** Separation of amino acids and proteins. **(Demonstration)** Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5& 6–not for ESE)		

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B	Section C
			MCQs			
			No. of. Questions	K - Level		
Model Exam	CO1	K1 – K4	5	K1		
	CO2	K1 – K4	5	K2		
	CO3	K1 – K4				1(K4)
	CO4	K1 – K4				1 (K3)
	CO5	K1- K4			1 (K3)	
Question Pattern Model exam		No. of Questions to be asked	10		1	2
		No. of Questions to be answered	10		1	2
		Marks for each question	1		10	10
		Total Marks for each section	10		10	20

Overall CIA marks (25) = (Model exam conducted for 40 marks is converted to 15 marks + regular class observation 10 marks)

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B K - LEVEL	Section C K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	5	K1		
2	CO2	K1 – K4	5	K2		
3	CO3	K1 – K4				1(K4)
4	CO4	K1 – K4				1(K3)
5	CO5	K1 – K4			1 (K3)	
No. of Questions to be Asked			10		1	2
No. of Questions to be answered			10		1	2
Marks for each question			1		10	15
Total Marks for each section			10		10	30
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Overall Summative Exam marks (75) = Exam marks (60) + Record marks (15)

Course Name	ALLIED MATHEMATICS - II			
Course Code	23UMTEA21	**L**	**P**	**C**
Category	ELECTIVE	5	-	4

COURSE OBJECTIVES:

- This course is designed for the students to expose the topics such as expansions of trigonometric functions, partial differential equations, and integration.
- To gain knowledge of expansions of trigonometric functions.
- To acquire the knowledge of solving partial differential equations.
- Basic knowledge of vector calculus.
- To understand and carry out the calculations of a given set of data

UNIT – I TRIGONOMETRY **15**

Expansions of sin n θ, cos n θ, sinnθ, cosnθ, tannθ – Expansions of sinθ, cosθ, tanθ in terms of θ – Hyperbolic and inverse hyperbolic functions – Logarithms of complex numbers.

UNIT – II PARTIAL DIFFERENTIAL EQUATION **15**

Formation-complete integrals and general integrals-Four standard types-Lagrange's equation.

UNIT - III VECTOR DIFFRENTIATION **15**

Vector functions- Derivative of a vector function- Scalar and vector point functions- Gradient of a scalar point function- Gradient- Directional derivatives –Unit vector normal to a surface– angle between the surfaces-divergence, curl.

UNIT – IV VECTOR INTEGRATION **15**

Green's theorem in the plane- Gauss divergence theorem- Stoke's theorem [without proofs].

UNIT - V FINITE DIFFERENCE **15**

Operator E, Relation between Δ ,∇ and E – Interpolation – Newton – Gregory forward & backward formulae for interpolation- Lagrange's interpolation formula for unequal intervals(without proof) .

Total Lecture Hours **75**

BOOKS FOR STUDY:

- P. Duraipandian and S. Udayabaskaran(1997), "Allied Mathematics", Vol I & II. Chennai: Muhil Publishers.

  Unit-I: Chapter 6 (6.1,6.1.1-6.1.3,6.2,6.2.1-6.2.3,6.3,6.4), Vol I,

  Unit-II: Chapter :6 (6.1,6.1.1,6.2,6.3,6.4), Vol II,

  Unit-III Chapter 8 - (8.1,8.1.1,8.2,8.3,8.3.1,8.3.2,8.4,8.4.1,8.4.2,8.4.3,8.4.4),Vol I,

  Unit-IV: Chapter 8 - (8.6.1 - 8.6.3), Vol I,

  Unit-V: Chapter 5 - (5.1,5.2) Vol II

BOOKS FOR REFERENCES:

- S.P.Rajagopalan and R.Sattanathan(2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
- S.J.Venkatesan, "Allied Mathematics - II", Sri Krishna Publications, Chennai.
- P. R. Vittal (2003), "Allied Mathematics", Margham Publications, Chennai.
- P.Kandhasamy, K. Thilagavathy (2003), "Allied Mathematics" Vol I & II, New Delhi: Tata McGraw Hill.
- P.Kandasamy, K.Thilagavathy (2003) Calculus of Finite differences & Numerical Analysis,S. Chand & Company Ltd., New Delhi-55.

WEB RESOURCES:

- **https;//www.mathwarehous.com/**
- **https;//www.mathhelp.com/**
- **https;//www.mathsisfun.com/**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL	✓	NATIONAL		GLOBAL	
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Find out the expansions of trigonometric functions and carry out problems related to hyperbolic and inverse hyperbolic functions.	K1 to K4
CO2	Provide a basic knowledge of partial differential equations and develops knowledge on handling practical problems. Develop the skills of finding roots of simultaneous equations	K1 to K4
CO3	Demonstrate knowledge of solving problems involving vector and scalar functions.	K1 to K4
CO4	Carry out calculations of problems related to vector integration	K1 to K4
CO5	Evaluate finite differences using various interpolation methods	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	3	3	2	3				
CO2	2	2	2	3	2	3				
CO3	3	2	2	3	1	1				
CO4	1	2	2	1	2	3				
CO5	3	2	2	1	2	3				

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:

UNIT	ALLIED MATHEMATICS – II	HRS	PEDAGOGY
I	Expansions of sin n θ, cos n θ, sinnθ, cosnθ, tannθ – Expansions of sinθ, cosθ, tanθ in terms of θ – Hyperbolic and inverse hyperbolic functions – Logarithms of complex numbers.	15	Chalk & Talk
II	Formation-complete integrals and general integrals-Four standard types-Lagrange's equation	15	Chalk & Talk

III	Vector functions- Derivative of a vector function- Scalar and vector point functions- Gradient of a scalar point function-Gradient-Directional derivatives –Unit vector normal to a surface– angle between the surfaces-divergence, curl..	**15**	**Chalk & Talk**
IV	Green's theorem in the plane- Gauss divergence theorem- Stoke's theorem [without proofs].	**15**	**Chalk & Talk**
V	Operator E, Relation between Δ ,∇ and E – Interpolation – Newton – Gregory forward & backward formulae for interpolation- Lagrange's interpolation formula for unequal intervals(without proof) .	**15**	**Chalk & Talk**

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	**Cos**	**K Level**	**Section A**		**Section B Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K4**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	**K1 – K4**	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K4**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K4**	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2	10		2	3.6	
	K3		10	16	26	46.4	46.4
	K4			16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	**Section A (Multiple Choice Questions)**	**Section B (Either or Choice**	**Section C (Either/ or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**5**			**5**	**3.6**	**4**
K2	**5**	**20**		**25**	**17.8**	**18**
K3		**30**	**32**	**62**	**44.3**	**44**
K4			**48**	**48**	**34.3**	**34**
Marks	**10**	**50**	**80**	**140**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	**Unit**	**CO**	**K-level**		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	ALLIED BOTANY - II			
Course Code	23UMBEA22	**L**	**P**	**C**
Category	ALLIED	5	-	4

COURSE OBJECTIVES:

- To understand the fundamental concepts of plant parts and their morphology.
- To analyze and recognize the main taxonomic ranks in plants.
- To understand the concepts in the types and mechanisms involved in disease establishment.
- To classify the different agents that can cause infection in plants and their methods of spread.
- To classify the methods of managing plant diseases to prevent or minimize loss.

UNIT - I MORPHOLOGY OF PLANTS 12

Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types – Brief descriptions only.

UNIT - II PLANT TAXONOMY 12

Introduction to Taxonomy and Systematics – Identification, Classification and Nomenclature – Binomial system of naming plants, Brief descriptions of the major groups in plant taxonomy – Plant Kingdom, Division, Class, Order, Family, Genus and species.

UNIT - III ANATOMY 12

Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.

UNIT - IV EMBRYOLOGY 12

Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.

UNIT - V PLANT PHYSIOLOGY 12

Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination Question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved/ (To be discussed during the Tutorial hour)

Total Lecture Hours 60

BOOKS FOR STUDY:

- Agrios George N. 2005. Plant Pathology. 5th Edition, Elsevier Press, London, NY, Tokyo.
- Narayanasamy P. 2011. Microbial Plant Pathogens – Detection and Disease Diagnosis. Fungal Pathogens – Vol. 1, Springer Dordrecht Heidelberg. London and New York.
- Narayanasamy P. 2011. Microbial Plant Pathogens – Detection and Disease Diagnosis. Bacterial and Phytoplasmal Pathogens – Vol. 2, Springer Dordrecht Heidelberg. London and New York.
- Narayanasamy P. 2011. Microbial Plant Pathogens – Detection and Disease Diagnosis. Viral and viroid Pathogens – Vol. 3, Springer Dordrecht Heidelberg. London and New York.
- Ting, I.P. 1982. Plant Physiology.Addison Wesley Pb. Philippines.

BOOKS FOR REFERENCES:

- Gillings Michael and Andrew Holmes, Editors. 2005. Plant Microbiology, BIOS Scientific Publishers, Taylor and Francis Group, London and NY.
- Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
- Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
- Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.
- Balaji Aglave, 2018. Handbook of Plant Disease Identification and Management. 1st Kindle edition. CRC Press. Florida.

WEB RESOURCES:

- **https://portal.ct.gov/CAES/Fact-Sheets/Plant-Pathology/Plant-Health-Problems#:~:text= COMMON%20SYMPTOMS%20OF%20PLANT %20DISEASE,flowers%2C%20or%20the%20entire%20plant.**
- **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7604890/**
- **https://byjus.com/neet/anatomy-of-root-stem-and-leaf/**
- **https://www.apsnet.org/edcenter/disimpactmngmnt/topc/EpidemiologyTemporal/Pages/ ManagementStrategies.aspx**
- **https://www.botanyyworld.com/inflorescence/**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**								

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Understand the fundamental concepts of plant anatomy.	K1 to K4
CO2	Analyze and recognize the different ranks in plant taxonomy	K1 to K4
CO3	Understand the types and various factors of plant diseases.	K1 to K4
CO4	Classify the different biological agents causing plant infections, symptoms and their transmission.	K1 to K4
CO5	Classify the methods of plant protection to avoid or minimize loss.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3					
CO2	3	3	3	3	3					
CO3	2	3	3	3	3					
CO4	3	3	2	3	3					
CO5	3	2	2	2	2					

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	1	3	3	3	3
CO 4	3	3	2	3	2
CO 5	2	2	1	2	2
WEIGHTAGE	12	14	12	14	13
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	3	3	3	3

LESSON PLAN:

UNIT		HRS	PEDAGOGY
I	Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types – Brief descriptions only	12	PPT/CHALK AND TALK
II	Introduction to Taxonomy and Systematics – Identification, Classification and Nomenclature – Binomial system of naming plants, Brief descriptions of the major groups in plant taxonomy – Plant Kingdom, Division, Class, Order, Family, Genus and species.	12	PPT/CHALK AND TALK

III	Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.	**12**	**PPT/CHALK AND TALK**
IV	Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.	**12**	**PPT/CHALK AND TALK**
V	Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.	**12**	**PPT/CHALK AND TALK**

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	CO3	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2	10		2	3.6	
	K3		10	16	26	46.4	46.4
	K4			16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K4	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K4	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	**Section A (Multiple Choice Questions)**	**Section B (Either or Choice**	**Section C (Either/ or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**5**			**5**	**3.6**	**4**
K2	**5**	**20**		**25**	**17.8**	**18**
K3		**30**	**32**	**62**	**44.3**	**44**
K4			**48**	**48**	**34.3**	**34**
Marks	**10**	**50**	**80**	**140**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	**Unit**	**CO**	**K-level**		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	DAIRY CHEMISTRY			
Course Code	23UCHNM21	**L**	**P**	**C**
Category	NON - MAJOR ELECTIVE	2	-	2

COURSE OBJECTIVES:

This course aims at providing an overall view of the

- chemistry of milk and milk products
- processing of milk
- Preservation and formation of milk products.

UNIT - I COMPOSITION OF MILK **06**

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 **06**

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 **06**

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 – desi butter - salted butter, 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 **06**

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	06
Fermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - Bulgarious milk -acidophilous milk – Yoheer Indigeneous products- khoa and chhena definition - 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.	
Total Lecture Hours	**30**

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

- Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005.
- F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006.
- Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980.
- P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016. Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A. OMahony, Springer, Second edition, 2015.

WEB RESOURCES:

- **https://archive.nptel.ac.in/courses/126/105/126105013/**
- **http://ecoursesonline.iasri.res.in/course/index.php?categoryid=10**

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP					
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		✓	GLOBAL				
Changes Made in the Course	Percentage of Change			No Changes Made			New Course		✓			

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Understand about general composition of milk – constituents and its physical properties.	K1 to K2
CO2	Acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.	K1 to K2
CO3	learn about Cream and Butter their composition and how to estimate fat in cream and Ghee	K1 to K2
CO4	Explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.	K1 to K2
CO5	have an idea about how to make milk powder and its drying process - types of drying process	K1 to K2

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	Dairy Chemistry	HRS	PEDAGOGY
I	Composition of Milk Milk-definition-general composition of milk-constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity -Factors affecting the composition of milk - adulterants, preservatives with neutralizer- examples and their detection- estimation of fat, acidity and total solids in milk.	6	Chalk & talk

II	Processing of Milk Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing - boiling, pasteurization – types of pasteurization -Bottle, Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.	**6**	**Chalk & talk, videos**
III	Major Milk Products 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 – desi butter - salted butter, 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.	**6**	**Ppt , Chalk & talk, videos**
IV	Special Milk Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk - condensed milk - definition, composition and nutritive value.	**6**	**Chalk & talk, ppt**
V	Fermented and other Milk Products Fermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - Bulgarious milk -acidophilous milk – Yoheer Indigeneous products-khoa and chhena definition - 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.	**6**	**Chalk & talk, ppt**

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	**Cos**	**K Level**	**Section A**	
			MCQs	
			No. of. Questions	**K - Level**
CI AI	**CO1**	**K1 – K2**	**25**	**K1,K2**
	CO2	**K1 – K2**	**25**	**K1,K2**
CI AII	**CO3**	**K1 – K2**	**25**	**K1,K2**
	CO4	**K1 – K2**	**25**	**K1,K2**
Question Pattern CIA I & II		**No. of Questions to be asked**	**50**	
		No. of Questions to be answered	**50**	
		Marks for each question	**1**	
		Total Marks for each section	**50**	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (Ist Test-2 CO's & IInd Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	**30**	**30**	**60**	**100**
	K2	**20**	**20**	**40**	
	K3				
	K4				
	Marks	**50**	**50**	**100**	**100**
CIA II	**K1**	**30**	**30**	**60**	**100**
	K2	**20**	**20**	**40**	
	K3				
	K4				
	Marks	**50**	**50**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	COs	K - Level	Section A (MCQs)	
			No. of Questions	K – Level
1	CO1	K1-K2	15	K1,K2
2	CO2	K1-K2	15	K1,K2
3	CO3	K1-K2	15	K1,K2
4	CO4	K1-K2	15	K1,K2
5	CO5	K1-K2	15	K1,K2
No. of Questions to be Asked			75	
No. of Questions to be answered			75	
Marks for each question			1	
Total Marks for each section			75	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	Section A (Multiple Choice Questions)	Total Marks	% of (Marks without choice)	Consolidated %
K1	40	40	53	100
K2	35	35	47	
K3				
K4				
Marks		75	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				

Course Name	COSMETICS AND PERSONAL CARE PRODUCTS			
Course Code	23UCHSC21	**L**	**P**	**C**
Category	SKILL ENHANCEMENT COURSE	2	-	2

COURSE OBJECTIVES:

This course aims at familiarizing the students with

- formulations of various types of cosmetics and their significance
- hair, skin and dental care makeup preparations and personal grooming

UNIT - I SKIN CARE **06**

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 & DENTAL CARE **06**

Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients;Tooth pastes – ingredients – mouth wash.

UNIT - III MAKE UP **06**

Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge.

UNIT - IV PERFUMES **06**

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 **06**

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

Total Lecture Hours **30**

BOOKS FOR STUDY:

- Thankamma Jacob, (1997) Foods, drugs and cosmetics – A consumer guide, Macmillan publication, London.

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

- **http://www.khake.com/page75.html**
- **Net. foxsm/list/284**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED		ENTREPRENEURSHIP	✓		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL	
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	know about the composition of various cosmetic products	**K1 to K2**
CO2	Understand chemical aspects and applications of hair care and dental care and skin care products.	**K1 to K2**
CO3	Understand chemical aspects and applications of perfumes and skin care products.	**K1 to K2**
CO4	to understand the methods of beauty treatments their advantages and disadvantage.	**K1 to K2**
CO5	Understand the hazards of cosmetic products.	**K1 to K2**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO2	**M**	**S**	**S**	**S**	**M**	**S**	**S**	**M**
CO3	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**M**
CO4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**M**

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:					
COS	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**3**	**3**	**3**	**3**	**3**
CO 2	**3**	**3**	**3**	**3**	**3**
CO 3	**3**	**3**	**3**	**3**	**3**
CO 4	**3**	**3**	**3**	**3**	**3**
CO 5	**3**	**3**	**3**	**3**	**3**
WEIGHTAGE	**15**	**15**	**15**	**15**	**15**
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**

LESSON PLAN:

UNIT	Cosmetics and Personal Care Products	HRS	PEDAGOGY
I	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.	**6**	**Chalk & talk, ppt**
II	Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients Tooth pastes – ingredients – mouth wash	**6**	**Chalk & talk, ppt**
III	Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge	**6**	**Chalk & talk, ppt**
IV	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	**6**	**Chalk & talk, ppt**
V	Facials - types – advantages – disadvantages; face masks – types;bleach -types– advantages– disadvantages; shaping the brows; eyelash tinting; perming types; hair colouring and dyeing ;permanent waving– hair straightening; wax types – waxing; pedicure,manicure - advantages – disadvantages	**6**	**Chalk & talk, ppt**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	**Cos**	**K Level**	**Section A**	
			MCQs	
			No. of. Questions	**K - Level**
CI AI	**CO1**	**K1 – K2**	**25**	**K1,K2**
	CO2	**K1 – K2**	**25**	**K1,K2**
CI AII	**CO3**	**K1 – K2**	**25**	**K1,K2**
	CO4	**K1 – K2**	**25**	**K1,K2**
Question Pattern CIA I & II		**No. of Questions to be asked**	**50**	
		No. of Questions to be answered	**50**	
		Marks for each question	**1**	
		Total Marks for each section	**50**	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (Ist Test-2 CO's & IInd Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	**30**	**30**	**60**	**100**
	K2	**20**	**20**	**40**	
	K3				
	K4				
	Marks	**50**	**50**	**100**	**100**
CIA II	**K1**	**30**	**30**	**60**	**100**
	K2	**20**	**20**	**40**	
	K3				
	K4				
	Marks	**50**	**50**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	**COs**	**K - Level**	**Section A (MCQs)**	
			No. of Questions	**K – Level**
1	**CO1**	**K1-K2**	**15**	**K1,K2**
2	**CO2**	**K1-K2**	**15**	**K1,K2**
3	**CO3**	**K1-K2**	**15**	**K1,K2**
4	**CO4**	**K1-K2**	**15**	**K1,K2**
5	**CO5**	**K1-K2**	**15**	**K1,K2**
No. of Questions to be Asked			**75**	
No. of Questions to be answered			**75**	
Marks for each question			**1**	
Total Marks for each section			**75**	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**40**	**40**	**53**	**100**
K2	**35**	**35**	**47**	
K3				
K4				
Marks		**75**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				

B.Sc., CHEMISTRY

Syllabus

Program Code: UCH

2023 - Onwards

MANNAR THIRUMALAI NAICKER COLLEGE

(AUTONOMOUS)

Re-accredited with "A" Grade by NAAC

PASUMALAI, MADURAI – 625 004

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS), MADURAI – 625 004

B.SC CHEMISTRY CURRICULUM

(For the student admitted from the academic year 2023-2024 onwards)

Course Code	Title of the Course	Hrs	Credits	Maximum Marks		
				Int	Ext	Total
THIRD SEMESTER						
Part – I	**Tamil / Alternative course**					
23UTAGT31	தமிழக வரலாறும் பண்பாடும்	6	3	25	75	100
Part – II	**English**					
23UENGE31	GENERAL ENGLISH - III	6	3	25	75	100
Part - III	**Core courses**					
23UCHCC31	GENERAL CHEMISTRY - III	5	5	25	75	100
23UCHCP31	QUALITATIVE INORGANIC ANALYSIS	3	2	25	75	100
Part - III	**Elective courses**					
23UPHEA31	ALLIED PHYSICS- I	4	4	25	75	100
23UPHEP31	ALLIED PHYSICS PRACTICAL - I	2	2	25	75	100
Part - IV	**Skill Based courses**					
23UCHSC31	PESTICIDE CHEMISTRY	2	2	25	75	100
23UCHSC32	ENTREPRENEURIAL SKILLS IN CHEMISTRY	1	1	25	75	100
Part - IV	**Mandatory course**					
23UEVSG41	ENVIRONMENTAL STUDIES	1	-	-	-	-
	Total	30	22	200	600	800
FOURTH SEMESTER						
Part – I	**Tamil / Alternative course**					
23UTAGT41	தமிழும் அறிவியலும்	6	3	25	75	100
Part – II	**English**					
23UENGE41	GENERAL ENGLISH - IV	6	3	25	75	100
Part - III	**Core courses**					
23UCHCC41	GENERAL CHEMISTRY - IV	5	5	25	75	100
23UCHCP41	PHYSICAL CHEMISTRY PRACTICAL - I	3	3	25	75	100
Part - III	**Elective courses**					
23UPHEA41	ALLIED PHYSICS - II	4	4	25	75	100
23UPHEP41	ALLIED PHYSICS PRACTICAL - II	2	2	25	75	100
Part - IV	**Skill Based courses**					
23UCHSC41	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS	2	2	25	75	100
23UCHSC42	FORENSIC SCIENCE	1	1	25	75	100
Part - IV	**Mandatory Course**					
23UEVSG41	ENVIRONMENTAL STUDIES	1	2	25	75	100
	Total	30	25	225	675	900

THIRD SEMESTER

Course Name	GENERAL CHEMISTRY - III			
Course Code	23UCHCC31	**L+T**	**P**	**C**
Category	CORE	4+1	-	5

COURSE OBJECTIVES:

This course aims to provide a comprehensive knowledge on

- the physical properties of gases, liquids, solids and X-ray diffraction of solids.
- fundamentals of nuclear chemistry and nuclear waste management.
- applications of nuclear energy.
- basic chemistry of halo-organic compounds, phenol and other aromatic alcohols.
- preparation and properties of phenols and alcohols.

UNIT - I Gaseous state **12+3**

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 and viscosity of gases (definitions alone).

Real gases: Deviations from ideal gas behaviour; compressibility factor, Z. equations of states for real gases-van der Waal's equation; Numerical problems based on equations of states for real gases, isotherms of real gases – critical phenomena – isotherms of CO_2 liquefaction-of gases;

UNIT - II Liquid and Solid State **12+3**

Liquid State: Properties of Liquids- Surface tension, viscosity and their applications. Liquid crystals – classification and applications.

Solid State: Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism.

Crystals: Crystals –size and shape; laws of crystallography; 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 (derivation)

Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; Defects in solids - stoichiometric and nonstoichiometric defects.

UNIT - III Nuclear Chemistry **12+3**

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 from half life period, radiocarbon dating and binding energy) Applications of radioactive isotopes.

Nuclear energy; nuclear fission and fusion (definition and differences) – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.

UNIT - IV Halogen derivatives **12+3**

Aliphatic halogen derivatives: Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – SN_1, SN_2 and SN_i mechanisms with stereochemical aspects and effect of solvent; Preparation, properties and applications of $CHCl_3$ and CCl_4.

Aromatic halogen compounds: Nomenclature - preparation, properties and uses of Chlorobenzene, Mechanism of nucleophilic aromatic substitution – benzyne intermediate.

Aryl alkyl halides: Nomenclature, benzyl chloride – preparation – properties and uses

Alcohols: Nomenclature, classification, preparation, properties, uses of ethanol; test for hydroxyl groups.

UNIT - V Phenols **12+3**

Phenols: Nomenclature; classification, Preparation from diazonium salts, Dow's process, Raching process. Properties – acidic character and effect of substitution on acidity; Reactions – Fries, Claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Libermann, nitro reaction, phthalein reaction. Resorcinol, picric acid – preparation and uses.

Benzyl alcohol: Nomenclature, benzyl alcohol – methods of preparation – reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, thionyl chloride, hydrogen iodide, oxidation – uses.

Thiol: preparation and uses of ethyl mercaptan.

Total Lecture & Tutorial Hours	**75**

BOOKS FOR STUDY:

- B.R. Puri, L.R. Sharma, M.S. Pathania; Principles of Physical Chemistry, 46th edition, Vishal Publishing, 2020.
- B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.
- P. L. Soni, and H. M.Chawla - Text Book of Organic Chemistry, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.

BOOKS FOR REFERENCES:

- H. J. Arnikar, Essentials of Nuclear Chemistry, New age international Publishers, fourth edition, Reprint, 2005.
- M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2003.
- J.D. Lee, Concise Inorganic Chemistry, Blackwell Science, fifth edition, 2005.
- P.L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, Sultan Chand &

amp; Sons, twentieth edition, 2006.

WEB RESOURCES:

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

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	explain the kinetic properties of gases by using mathematical concepts.	**K1 to K4**
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 determinations.	**K1 to K4**
CO3	investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management.	**K1 to K4**
CO4	write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.	**K1 to K4**
CO5	investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG **M – MEDIUM** **L – LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	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 and viscosity of gases (definitions alone).	6	Chalk & talk, ppt
	Real gases: Deviations from ideal gas behaviour; compressibility factor, Z. equations of states for real gases- van der Waal's equation; Numerical problems based on equations of states for real gases, isotherms of real gases – critical phenomena – isotherms of CO_2 liquefaction-of gases;	6	Chalk & talk, ppt
I	Solved problems	3	Group discussion
II	Liquid State: Properties of Liquids- Surface tension, viscosity and their applications. Liquid crystals – classification and applications.	3	Chalk & talk, ppt
II	Solid State: Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism.	3	Chalk & talk, ppt
II	Crystals: Crystals –size and shape; laws of crystallography; symmetry elements – plane, centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg's	3	Chalk & talk, ppt

	equation (derivation)		
II	Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; Defects in solids - stoichiometric and nonstoichiometric defects.	**3**	**Chalk & talk, ppt**
II	Solved problems	**3**	**Group discussion**
III	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	**6**	**Chalk & talk, ppt**
III	Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems from half life period, radiocarbon dating and binding energy) Applications of radioactive isotopes.	**3**	**Chalk & talk, ppt**
III	Nuclear energy; nuclear fission and fusion (definition and differences) – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.	**3**	**Chalk & talk, ppt**
III	Solved problems	**3**	**Group discussion**
IV	**Aliphatic halogen derivatives:** Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – SN_1, SN_2 and SN_i mechanisms with stereochemical aspects and effect of solvent. preparation, properties and applications of $CHCl_3$ and CCl_4	**4**	**Chalk & talk, ppt**
IV	**Aromatic halogen compounds:** Nomenclature - preparation, properties and uses of Chlorobenzene, Mechanism of nucleophilic aromatic substitution – benzyne intermediate.	**4**	**Chalk & talk, ppt**
IV	**Aryl alkyl halides:** Nomenclature, benzyl chloride – preparation – properties and uses **Alcohols:** Nomenclature, classification, preparation, properties, uses of ethanol; test for hydroxyl groups.	**4**	**Chalk & talk, ppt**
IV	Solved problems	**3**	**Group**

			discussion
V	**Phenols :** Nomenclature; classification, Preparation from diazonium salts, Dow's process, Raching process. Properties – acidic character and effect of substitution on acidity; Reactions – Fries, Claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Libermann, nitro reaction, phthalein reaction. Resorcinol, picric acid – preparation and uses.	**6**	**Chalk & talk, ppt**
V	**Benzyl alcohol:** Nomenclature, benzyl alcohol – methods of preparation – reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, thionyl chloride, hydrogen iodide, oxidation – uses.	**5**	**Chalk & talk, ppt**
V	**Thiol:** preparation and uses of ethyl mercaptan.	**1**	**Chalk & talk, ppt**
IV	Solved problems	**3**	**Group discussion**

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1	2 (K2,K2)	2(K3,K3)
	CO2	K1 – K4	2	K2	2(K3,K3)	2(K4,K4)
CI AII	CO3	K1 – K4	2	K1	2(K2,K2)	2(K3,K3)
	CO4	K1 – K4	2	K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1-K4	2	K1&K2	2 (K2)	2 (K3)
2	CO2	K1-K4	2	K1&K2	2 (K3)	2 (K4)
3	CO3	K1-K4	2	K1&K2	2 (K2)	2 (K3)
4	CO4	K1-K4	2	K1&K2	2 (K3)	2 (K4)
5	CO5	K1-K4	2	K1&K2	2 (K4)	2 (K3)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	**Section A (Multiple Choice Questions)**	**Section B (Either or Choice**	**Section C (Either/ or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**5**	**-**	**-**	**5**	**3.57**	**21.43**
K2	**5**	**20**	**-**	**25**	**17.86**	
K3	**-**	**20**	**48**	**68**	**48.57**	**48.57**
K4	**-**	**10**	**32**	**42**	**30**	**30**
Marks	**10**	**50**	**80**	**140**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	**Unit**	**CO**	**K-level**		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K4**	
		OR		
15. b)	**Unit - V**	**CO5**	**K4**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K3**	
		OR		
20. b)	**Unit - V**	**CO5**	**K3**	

Course Name	QUALITATIVE INORGANIC ANALYSIS			
Course Code	23UCHCP31	**L+T**	**P**	**C**
Category	CORE	-	3	2

COURSE OBJECTIVES:

This course aims at providing skill on

- laboratory safety
- Qualititative estimation
- Analytical ability
- Identifying various types of radicals
- Removal of interfering radicals

Semi-micro qualitative inorganic analysis:

- Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, nitrate.
- Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate
- Elimination of interfering acid radicals and Identifying the group of basic radicals.
- Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium
- Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)

Total Lecture Hours	**45**

BOOKS FOR STUDY:

- Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. *Basic Principles of Practical Chemistry,* 2nd ed.; Sultan Chand & Sons: New Delhi, 1997.
- 'Vogel's Textbook of Macro and Semi Micro Qualitative Inorganic Analysis', Orient Longman Ltd. 5th Ed.

BOOKS FOR REFERENCES:

- Vogel's Textbook of Qualitative Chemical Analysis, 6th ed.; Pearson Education Ltd: New Delhi, 2009.
- V. V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, National publishing House, Chennai, 2008.

WEB RESOURCES:

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

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL	
Changes Made in the Course	Percentage of Change	15	No Changes Made		New Course			

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	acquire knowledge on the systematic analysis of Mixture of salts.	**K1 to K4**
CO2	identify the cations and anions in the unknown substance.	**K1 to K4**
CO3	remove interfering radicals from mixture	**K1 to K4**
CO4	identify the cations and anions in the soil and water and to test the quality of water.	**K1 to K4**
CO5	assess the role of common ion effect and solubility product	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG **M – MEDIUM** **L – LOW**

CO / PO MAPPING:					
COS	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**3**	**3**	**3**	**3**	**3**
CO 2	**3**	**3**	**3**	**3**	**3**
CO 3	**3**	**3**	**3**	**3**	**3**
CO 4	**3**	**3**	**3**	**3**	**3**
CO 5	**3**	**3**	**3**	**3**	**3**
WEIGHTAGE	**15**	**15**	**15**	**15**	**15**
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, iodide, nitrate.	**9**	**Demonstration and training**
II	Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite.	**9**	**Demonstration and training**
III	Elimination of interfering acid radicals and Identifying the group of basic radicals.	**9**	**Demonstration and training**
IV	Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium	**9**	**Demonstration and training**
V	Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)	**9**	**Demonstration and training**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)			
Internal	**COs**	**K Level**	**Section**
Model Exam	**CO1**	**K1 – K4**	**1 (K4)**
	CO2	**K1 – K4**	**1 (K4)**
	CO3	**K1 – K4**	**1 (K3)**
	CO4	**K1 – K4**	**1 (K4)**
	CO5	**K1- K4**	**1 (K4)**
Question Pattern Model exam		No. of Questions to be asked	**5**
		No. of Questions to be answered	**5**
		Marks for each question	**12**
		Total Marks for each section	**60**

Overall CIA marks(25) = (Model exam conducted for 60 marks is converted to 15 marks + regular class observation 10 marks)

Internal Examinations - Question Paper – Format

Answer **ALL** the questions				**(5 x 12 = 60 Marks)**
1.	Unit I	CO1	K4	
2.	Unit II	CO2	K4	
3.	Unit III	CO3	K3	
4.	Unit IV	CO4	K4	
5.	Unit V	CO5	K4	

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)			
S. No	**COs**	**K - Level**	**SECTION**
1	CO1	**K1 – K4**	**1 (K4)**
2	CO2	**K1 – K4**	**1 (K4)**
3	CO3	**K1 – K4**	**1 (K3)**
4	CO4	**K1 – K4**	**1 (K4)**
5	CO5	**K1- K4**	**1 (K4)**
No. of Questions to be Asked			**5**
No. of Questions to be answered			**5**
Marks for each question			**12**
Total Marks for each section			**60**
(Figures in parenthesis denotes, questions should be asked with the given K level)			

Overall Summative Exam marks (75) = Exam marks (60) + Record marks(10) + viva (5)

Summative Examinations - Question Paper – Format

Answer **ALL** the questions				**(5 x 12 = 60 Marks)**
1.	Unit I	CO1	K4	
2.	Unit II	CO2	K4	
3.	Unit III	CO3	K3	
4.	Unit IV	CO4	K4	
5.	Unit V	CO5	K4	

10 marks to be awarded for proper record submission.

Course Name	ALLIED PHYSICS – I			
Course Code	23UPHEA31	**L**	**P**	**C**
Category	ALLIED PAPER	4	-	4

COURSE OBJECTIVES:

- To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.

UNIT - I WAVES, OSCILLATIONS AND ULTRASONICS **12**

Simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – applications of ultrasonics

UNIT - II PROPERTIES OF MATTER **12**

Elasticity: elastic constants – bending of beam – theory of non- uniform bending – determination of Young's modulus by non-uniform bending – energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum

Viscosity: streamline and turbulent motion – critical velocity – coefficient of viscosity – Poiseuille's formula – comparison of viscosities – burette method,

Surface tension: definition – molecular theory – droplets formation.

UNIT - III HEAT AND THERMODYNAMICS **12**

Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– importance of cryocoolers – thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process

UNIT - IV ELECTRICITY AND MAGNETISM **12**

Potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit

UNIT - V DIGITAL ELECTRONICS **12**

Logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem – verification

Total Lecture & Tutorial Hours **60**

BOOKS FOR STUDY:

- R.Murugesan (2001), Allied Physics, S. Chand & Co, New Delhi.
- Brijlal and N.Subramanyam (1994), Waves and Oscillations, Vikas Publishing House, New Delhi.
- Brijlal and N.Subramaniam (1994), Properties of Matter, S.Chand & Co., New Delhi.
- J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8th edition), S.Chand & Co., New Delhi.
- R.Murugesan (2005), Optics and Spectroscopy, S.Chand & Co ,New Delhi.
- A.Subramaniyam, Applied Electronics 2nd Edn., National Publishing Co., Chennai.

BOOKS FOR REFERENCES:

- Resnick Halliday and Walker (2018). Fundamentals of Physics (11th edition), John Willey and Sons, Asia Pvt .Ltd., Singapore.
- V.R.Khann aand R.S.Bedi (1998), Text book of Sound 1st Edn. Kedharnaath Publish & Co, Meerut.
- N.S.Khare and S.S.Srivastava (1983), Electricity and Magnetism 10th Edn., Atma Ram & Sons, New Delhi.
- D.R.Khanna and H.R. Gulati (1979). Optics, S. Chand Co. Ltd., New Delhi.
- V.K. Metha (2004).Principles of electronics 6th Edn. S.Chand and company.

WEB RESOURCES:

- **https://youtu.be/M_5KYncYNyc**
- **https://youtu.be/ljJLJgIvaHY**
- **https://youtu.be/7mGqd9HQ_AU**
- **https://youtu.be/h5jOAw57OXM**
- **https://learningtechnologyofficial.com/category/fluid-mechanics-lab/**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Explain types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically. Relate theory with practical applications in medical field	**K1 to K4**
CO2	Explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life.	**K1 to K4**
CO3	Comprehend basic concept of thermodynamics concept of entropy and associated theorems able to interpret the process of flow temperature physics in the background of growth of this technology.	**K1 to K4**
CO4	Articulate the knowledge about electric current resistance, capacitance in terms of potential electric field and electric field.	**K1 to K4**
CO5	Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks.	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**
CO1	3	3	2	2	3	2	2	3	2	3
CO2	2	3	3	3	2	2	3	2	3	3
CO3	3	2	3	2	3	3	2	3	3	3
CO4	3	3	3	3	3	2	3	2	2	2
CO5	2	2	3	3	2	3	3	3	3	2
S- STRONG			**M – MEDIUM**						**L – LOW**	

CO / PO MAPPING:					
COS	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	3	1	3	-	2
CO 2	3	1	3	-	2
CO 3	3	1	3	-	2
CO 4	3	1	3	-	2
CO 5	3	1	3	-	2
WEIGHTAGE					
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS					

LESSON PLAN:			
UNIT	**COURSE NAME**	**HRS**	**PEDAGOGY**
I	Simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – application of ultrasonics	**12**	**Lecture method, PPT, Demonstration**
II	*Elasticity*: elastic constants – bending of beam – theory of non- uniform bending – determination of Young's modulus by non-uniform bending – energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum *Viscosity*: streamline and turbulent motion – critical velocity – coefficient of viscosity – Poiseuille's formula – comparison of viscosities – burette method *Surface tension*: definition – molecular theory	**12**	**Lecture method, PPT, Demonstration**
III	Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– importance of cryocoolers– thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process.	**12**	**Lecture method, PPT, Demonstration**
IV	Potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit	**12**	**Lecture method, PPT, Demonstration**
V	Logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem – verification.	**12**	**Lecture method, PPT, Demonstration**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	**Cos**	**K Level**	**Section A**		**Section B Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K4**	2	K1, K2	K1 OR K1	K3 OR K3
	CO2	**K1 – K4**	2	K1,K2	K2 OR K2	K4 OR K4
CI AII	**CO3**	**K1 – K4**	2	K1, K2	K2 OR K2	K3 OR K3
	CO4	**K1 – K4**	2	K1,K2	K3 OR K3	K4 OR K4
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	**Section A (Multiple Choice Questions)**	**Section B (Either / Or Choice)**	**Section C (Either / Or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	2	10	-	12	**21.43**	-
	K2	2	10	-	12	**21.43**	
	K3	-	-	16	16	**28.57**	**42.86**
	K4	-	-	16	16	**28.57**	**71.43**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**
CIA II	**K1**	2			2	**3.57**	-
	K2	2	10		12	**21.43**	
	K3		10	16	26	**46.43**	**25.00**
	K4			16	16	**28.57**	**71.43**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1-K4	2	K1&K2	K1, K1	K2, K2
2	CO2	K1-K4	2	K1&K2	K2, K2	K2, K2
3	CO3	K1-K4	2	K1&K2	K2, K2	K3, K3
4	CO4	K1-K4	2	K1&K2	K3, K3	K3, K3
5	CO5	K1-K4	2	K1&K2	K4, K4	K4, K4
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.57	21.43
K2	5	20	-	25	17.86	
K3	-	20	48	68	48.57	48.57
K4	-	10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K1**	
		OR		
11. b)	**Unit - I**	**CO1**	**K1**	
12. a)	**Unit - II**	**CO2**	**K2**	
		OR		
12. b)	**Unit - II**	**CO2**	**K2**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K4**	
		OR		
15. b)	**Unit - V**	**CO5**	**K4**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K2**	
		OR		
16. b)	**Unit - I**	**CO1**	**K2**	
17. a)	**Unit - II**	**CO2**	**K2**	
		OR		
17. b)	**Unit - II**	**CO2**	**K2**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K3**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	ALLIED PHYSICS PRACTICAL – I			
Course Code	23UPHEP31	**L+T**	**P**	**C**
Category	ALLIED PRACTICAL	-	2	2

COURSE OBJECTIVES:

- Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

SEMESTER - I LIST OF EXPERIMENTS

Minimum of Eight Experiments from the list:

1. Young's modulus by non-uniform bending using pin and microscope
2. Young's modulus by non-uniform bending using optic lever, scale and telescope
3. Rigidity modulus by static torsion method.
4. Rigidity modulus by torsional oscillations without mass
5. Surface tension and interfacial Surface tension – drop weight method
6. Comparison of viscosities of two liquids – burette method
7. Specific heat capacity of a liquid – half time correction
8. Verification of laws of transverse vibrations using sonometer
9. Calibration of low range voltmeter using potentiometer
10. Determination of thermo emf using potentiometer
11. Verification of truth tables of basic logic gates using ICs
12. Verification of De Morgan's theorems using logic gate ICs.
13. Use of NAND as universal building block.

Note : Use of digital balance permitted

Total Lecture Hours	**30**

BOOKS FOR STUDY:

- Srinivasan.M.N., Balasubramanian.S., Ranganathan.R., A Text Book of Practical Physics, 2017 Edition, Sultan Chand & Sons

BOOKS FOR REFERENCES:

- Jouseph.C., Practical Physics and Electronics, 2013, S.Viswanathan.P.Ltd.
- Practical Physics and Electronics, C.C.Ouseph, U.J.Rao, V.Vijayendran, S.Viswanathan Publishers (2007)

WEB RESOURCES:

- **https://nptel.ac.in/course.html/physics/experimental physics I, II and III**
- **https://nptel.ac.in/courses/115/105/115105110/**
- **https://www.youtube.com/playlist?list=PLuiPz6iU5SQ8-rZn_LgLofRX7n8z4tHYK**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Remembering the Aim and apparatus used in the experiment	**K1 to K4**
CO2	Understanding of laws and formulas of the experiment	**K1 to K4**
CO3	Applying the knowledge to do the experiment	**K1 to K4**
CO4	Calculating and examining the aim of the experiment	**K1 to K4**
CO5	Interpreting the result of the experiment	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**
CO1	**3**	**3**	**1**	**1**	**2**	**3**	**3**	**3**	**1**	**3**
CO2	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**1**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**1**	**3**
CO5	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**1**	**3**
S- STRONG				**M – MEDIUM**					**L – LOW**	

CO / PO MAPPING:					
COS	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**3**	**2**	**3**	**-**	**2**
CO 2	**3**	**2**	**3**	**-**	**2**
CO 3	**3**	**2**	**3**	**-**	**2**
CO 4	**3**	**2**	**3**	**-**	**2**
CO 5	**3**	**2**	**3**	**-**	**2**
WEIGHTAGE					
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS					

LESSON PLAN:

SEM	ALLIED PHYSICS PRACTICALS – I	HRS	PEDAGOGY
I	1. Young's modulus by non-uniform bending using pin and microscope 2. Young's modulus by non-uniform bending using optic lever, scale and telescope 3. Rigidity modulus by torsional oscillations without mass 4. Comparison of viscosities of two liquids – burette method 5. Verification of laws of transverse vibrations using sonometer 6. Calibration of low range voltmeter using potentiometer 7. Verification of truth tables of basic logic gates using ICs 8. Use of NAND as universal building block.	**30**	**Demonstration and Video**

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total
25	75	100

Record Note and Attendance -10 mark
Model examination - 15 mark
Total CIA - 25 mark

Model examination should be conducted for 30 mark and it has to be converted to 15 mark

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	**Cos**	**K Level**	**No. of. Questions**	**K - Level**
CIA-I	**CO1 - CO5**	**K1 – K4**	**1** Question for Each Student	**K1 – K4**
Question Pattern CIA - I		No. of Questions to be asked	**1** Question for Each Student	
		No. of Questions to be answered	**1**	
		Marks for each question	**30**	
		Total Marks for each section	**30**	

Distribution of Marks with COs & K Level for Correction of CIA I				
	COs	**Distribution of the work of the experiment**	**K - Level**	**MARKS**
CIA I	**CO1**	Aim and apparatus	**K1**	**2.0**
	CO3	Formula and Tabular Column	**K2**	**5.0**
	CO5	Understanding and Observation	**K4**	**12.0**
	CO4	Calculation and Graph	**K3**	**8.0**
	CO2	Interpretation of result	**K1**	**3.0**
	Total Marks			**30**

Distribution of Marks with K Level CIA I					
	K Level	**Distribution of the work of the experiment**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	Aim and apparatus	5	16.67	-
	K2	Formula and Tabular Column Interpretation of result	5	16.67	
	K3	Calculation and Graph	8	26.66	**33.34**
	K4	Understanding and Observation	12	40.00	**60.00**
	Marks		**30**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)			
COs	**K - Level**	**No. of Questions**	**K – Level**
CO1 - CO5	**K1 – K4**	**1** Question for Each Student	**K1 – K4**
No. of Questions to be Asked		**1** Question for Each Student	
No. of Questions to be answered		**1**	
Marks for each question		**75**	
Total Marks for each section		**75**	
(Figures in parenthesis denotes, questions should be asked with the given K level)			

Distribution of Marks with COs & K Level for Correction of the Summative Exam			
COs	**Distribution of the work of the experiment**	**K - Level**	**MARKS**
CO1	Aim and apparatus	**K1**	**5**
CO3	Formula and Tabular Column	**K2**	**15**
CO5	Understanding and Observation	**K4**	**30**
CO4	Calculation and Graph	**K3**	**20**
CO2	Interpretation of result	**K1**	**5**
Total Marks			**75**

Distribution of Marks with K Level				
K Level	**Parameters for K-Level**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	Aim and apparatus	**10**	**13.33**	**-**
K2	Formula and Tabular Column, Interpretation of result	**15**	**20.00**	**13.33**
K3	Calculation and Graph	**20**	**26.67**	**33.33**
K4	Understanding and Observation	**30**	**40.00**	**60.00**
Marks		**75**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				

Course Name	PESTICIDE CHEMISTRY			
Course Code	23UCHSC31	**L**	**P**	**C**
Category	SKILL ENHANCEMENT COURSE	2	-	2

COURSE OBJECTIVES:

This course aims to providing the students

- knowledge about the various types of pesticides and their toxicity.
- insight on insecticides and their types.
- to understand the accumulation of pesticides in the form of residues.
- methods of analysis of pesticides.
- knowledge on choice of alternate and eco-friendly pesticides.

UNIT - I Introduction to pesticides and Toxicity of Pesticides 06

Overview of Pesticides, Chemistry of Pesticides: classes of pesticides - chemical targets, structures, chemical names, physical and chemical properties.

Toxicity of pesticides: Acute and chronic toxicity in mammals, birds, aquatic species. Methods of analysis of pesticides (AAS, NMR NAA).

UNIT - II Insecticides 06

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

UNIT - III Pesticides residues 06

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 06

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	06
Attractants and repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone. Comparison between biopesticides and chemical pesticides.	
Total Lecture & Tutorial Hours	**30**

BOOKS FOR STUDY:

- Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012.
- Kuldeep Singh, Raman Singh, An Introduction to Pesticide Chemistry , Notion press,2nd edition 2023

BOOKS FOR REFERENCES:

- Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors P Ltd; 1st Ed. 2010.
- Nollet L.M., Rathore H.S., Handbook of pesticides: methods of pesticide residues analysis. CRC press; 2016.

WEB RESOURCES:

- **https://ncert.nic.in/textbook.php**
- **https://tntextbooks.online/**
- **https://www.youtube.com/c/ncertofficial/videos**

Nature of Course	EMPLOYABILITY			SKILL ORIENTED		✓	ENTREPRENEURSHIP					
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		✓	GLOBAL				
Changes Made in the Course	Percentage of Change			No Changes Made			New Course		✓			

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	teach about the pesticides and their toxicity with respect to structure and category..	K1 & K2
CO2	explain the preparation and property of pesticides	K1 & K2
CO3	investigate the pesticide residues, prevention and care	K1 & K2
CO4	demonstrate the extraction and analytical methods of pesticide residues	K1 & K2
CO5	make awareness to the public on bio-pesticides	K1 & K2

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	S	S	S	S	S	S	S	M		
CO2	M	S	S	S	M	S	S	M		
CO3	S	S	S	M	S	S	S	M		
CO4	S	S	S	S	S	S	S	M		
CO5	S	M	S	S	S	S	S	M		
S- STRONG			M – MEDIUM					L – LOW		

CO / PO MAPPING:					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:			
UNIT	**COURSE NAME**	**HRS**	**PEDAGOGY**
I	Overview of Pesticides, Chemistry of Pesticides: classes of pesticides - chemical targets, structures, chemical names, physical and chemical properties. Toxicity of pesticides: Acute and chronic toxicity in mammals, birds, aquatic species. Methods of analysis of pesticides (AAS, NMR NAA).	**6**	**Chalk & talk, ppt**
II	Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses and toxicity; Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl and Propoxur.	**6**	**Chalk & talk, ppt**
III	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.	**6**	**Chalk , ppt& talk**
IV	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.	**6**	**Chalk & talk, ppt**
V	Attractants and repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone. Comparison between biopesticides and chemical pesticides.	**6**	**Chalk & talk, ppt**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	**Cos**	**K Level**	**Section A**	
			MCQs	
			No. of. Questions	**K - Level**
CI AI	**CO1**	**K1 – K2**	**25**	**K1,K2**
	CO2	**K1 – K2**	**25**	**K1,K2**
CI AII	**CO3**	**K1 – K2**	**25**	**K1,K2**
	CO4	**K1 – K2**	**25**	**K1,K2**
Question Pattern CIA I & II		**No. of Questions to be asked**	**50**	
		No. of Questions to be answered	**50**	
		Marks for each question	**1**	
		Total Marks for each section	**50**	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (I^{st} Test-2 CO's & II^{nd} Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	Section A (Multiple Choice Questions)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100
CIA II	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	COs	K - Level	Section A (MCQs)	
			No. of Questions	K – Level
1	CO1	K1-K2	15	K1,K2
2	CO2	K1-K2	15	K1,K2
3	CO3	K1-K2	15	K1,K2
4	CO4	K1-K2	15	K1,K2
5	CO5	K1-K2	15	K1,K2
No. of Questions to be Asked			75	
No. of Questions to be answered			75	
Marks for each question			1	
Total Marks for each section			75	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**40**	**40**	**53**	**100**
K2	**35**	**35**	**47**	
K3				
K4				
Marks		**75**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				

Course Name	ENTREPRENEURIAL SKILLS IN CHEMISTRY			
Course Code	23UCHSC32	**L**	**P**	**C**
Category	SKILL ENHANCEMENT COURSE	1	-	1

COURSE OBJECTIVES:

The course aims at providing training to

- Knowledge on food chemistry and food additives
- Insights on dyes used in foods
- develop entrepreneur skills in students
- to provide hands on experience to prepare and develop products
- develop start ups

UNIT - I	**Food Chemistry**	**03**

Essential nutrients in food (Carbohydrate, vitamins, fat, minerals) and its calorific value-Food adulteration- Common adulterants -contamination of food items with clay stones, water and toxic chemicals -. Electrochemical detection of adulterants.

UNIT - II	**Food Additives**	**03**

Natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast, MSG, vinegar.

UNIT - III	**Dyes**	**03**

Classification – Natural, synthetic dyes (malachite green, Rhodamine B, Tartrazine) and their characteristics – basic methods and principles of dyeing.

UNIT - IV	**Hands on Experience – I (Students can choose any two)**	**03**

Preparation of Jam, squash and Jelly, Gulkand, cottage cheese.
Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale.
Detection of adulterants in food items like milk, coffee powder, tea dust, ghee, butter, honey, pepper, chilli powder and turmeric powder employing basic techniques, UV-Visible and Thin layer chromatography methods.

UNIT - V	**Hands on Experience – II (Students can choose any two)**	**03**

Extraction of essential oils from herbal plants.
Testing of water samples using testing kit.
Dyeing – cotton fabrics with natural and synthetic dyes.
Printing – tie and dye, batik.

Total Lecture & Tutorial Hours	**15**

BOOKS FOR STUDY:

- B. Srilakshmi, New Age Food Science, New Age International publishers, Delhi, 2018.
- George S & Muralidharan V, Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai, 2007.
- S. Kumar, K. Chand, D. Kohli, R. Mishra, Practical Approaches in Food Science and Technology, Renu Publishers, First Edition, New Delhi, 2017.

BOOKS FOR REFERENCES:

- P. L. Soni, and H. M.Chawla - Text Book of Organic Chemistry, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.
- Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice),Elsevier, e Book ISBN 9087128004289, 1st Edition,2015

WEB RESOURCES:

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

Nature of Course	EMPLOYABILITY			SKILL ORIENTED			ENTREPRENEURSHIP		✓			
Curriculum Relevance	LOCAL		REGIONAL		✓	NATIONAL			GLOBAL			
Changes Made in the Course	Percentage of Change			No Changes Made			New Course		✓			
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**												

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	teach about the pesticides and their toxicity with respect to structure and category.	**K1 & K2**
CO2	explain the preparation and property of pesticides	**K1 & K2**
CO3	investigate the pesticide residues, prevention and care	**K1 & K2**
CO4	demonstrate the extraction and analytical methods of pesticide residues	**K1 & K2**
CO5	make awareness to the public on bio-pesticides	**K1 & K2**

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	S	S	S	S	S	S	S	M		
CO2	M	S	S	S	M	S	S	M		
CO3	S	S	S	M	S	S	S	M		
CO4	S	S	S	S	S	S	S	M		
CO5	S	M	S	S	S	S	S	M		
S- STRONG			M – MEDIUM					L – LOW		

CO / PO MAPPING:					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	Essential nutrients in food (Carbohydrate, vitamins, fat, minerals) and its calorific value-Food adulteration- Common adulterants -contamination of food items with clay stones, water and toxic chemicals -. Electrochemical detection of adulterants	3	Chalk & talk, ppt
II	Natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast, MSG, vinegar.	3	Chalk & talk
III	Classification – Natural, synthetic dyes (malachite green, rhodamine B, Tartrazine) and their characteristics – basic methods and principles of dyeing.	3	Chalk & talk
IV	Preparation of Jam, squash and Jelly, Gulkand, cottage	3	Demonstrat

	cheese. Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale. Detection of adulterants in food items like milk, coffee powder, tea dust, ghee, butter, honey, pepper, chilli powder and turmeric powder employing basic techniques, UV-Visible and Thin layer chromatography methods		**ion and working**
V	Extraction of essential oils from herbal plants. Testing of water samples using testing kit. Dyeing – cotton fabrics with natural and synthetic dyes Printing – tie and dye, batik.	**3**	**Demonstration and working**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	**Cos**	**K Level**	**Section A**	
			MCQs	
			No. of. Questions	**K - Level**
CI AI	**CO1**	**K1 – K2**	**25**	**K1,K2**
	CO2	**K1 – K2**	**25**	**K1,K2**
CI AII	**CO3**	**K1 – K2**	**25**	**K1,K2**
	CO4	**K1 – K2**	**25**	**K1,K2**
Question Pattern CIA I & II		**No. of Questions to be asked**	**50**	
		No. of Questions to be answered	**50**	
		Marks for each question	**1**	
		Total Marks for each section	**50**	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (Ist Test-2 CO's & IInd Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	Section A (Multiple Choice Questions)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100
CIA II	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

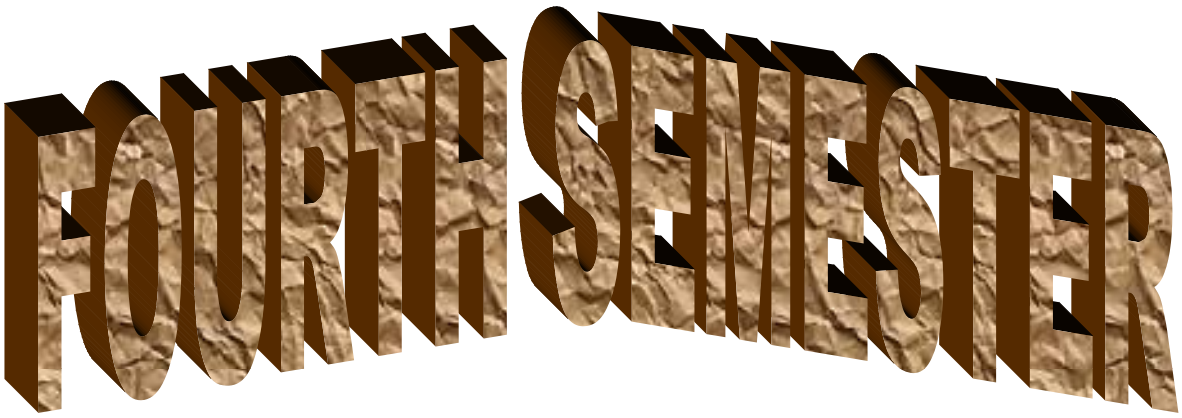
K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	COs	K - Level	Section A (MCQs)	
			No. of Questions	K – Level
1	CO1	K1-K2	15	K1,K2
2	CO2	K1-K2	15	K1,K2
3	CO3	K1-K2	15	K1,K2
4	CO4	K1-K2	15	K1,K2
5	CO5	K1-K2	15	K1,K2
No. of Questions to be Asked			75	
No. of Questions to be answered			75	
Marks for each question			1	
Total Marks for each section			75	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**40**	**40**	**53**	**100**
K2	**35**	**35**	**47**	
K3				
K4				
Marks		**75**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				


FOURTH SEMESTER

Course Name	GENERAL CHEMISTRY - IV			
Course Code	23UCHCC41	**L + T**	**P**	**C**
Category	CORE	4 + 1	-	5

COURSE OBJECTIVES:

This course aims to provide a comprehensive knowledge on

- thermodynamic concepts on chemical processes and applied aspects.
- thermo chemical calculations
- transition elements with reference to periodic properties and group study of transition metals.
- the organic chemistry of ethers, aldehydes and ketones
- the organic chemistry of carboxylic acids

UNIT - I Thermodynamics I **12 + 3**

Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, expansion of ideal gase under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson co-efficient- inversion temperature.

Thermochemistry - heats of reactions, standard states; types of heats of reactions; effect of temperature (Kirchhoff's equations); Hess's law and its applications; determination of bond energy; determination of calorific value of fuels Statement of Zeroth law of thermodynamics-Absolute Temperature scale.

UNIT - II Thermodynamics II **12 + 3**

Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, calculation of entropy changes of an ideal gas and with changes in temperature, volume and pressure.

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships.

Third law of thermodynamics - Nernst heat theorem and its applications; evaluation of absolute entropies from heat capacity measurements, exceptions to third law.

UNIT - III General Characteristics of d-block elements **12 + 3**

Transition Elements- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. comparison of II and III transition series with I transition series. Metallurgy of Manganese, chromium and iron

UNIT - IV Organic Compounds – I **12 + 3**

Ethers: Nomenclature, isomerism, general methods of preparations and reactions of diethyl ether. Zeisel's method of estimation of alkoxy group. Reactions of epoxides with alcohols, and $LiAlH_4$

Thioethers: nomenclature, structure, preparation, properties and uses of dimethyl sulphide.

Aldehydes and Ketones: Nomenclature, structure, preparation, properties and reactivity of aliphatic and aromatic aldehydes and ketones (acetaldehyde, benzaldehyde, acetone & acetophenone);

Reaction mechanisms - Aldol, Cannizzaro's, Perkin, Benzoin condensation and Knoevenagel reactions.

Baeyer - Villiger oxidation of ketones. Clemmensen reduction, Wolf - Kishner reduction, reduction with $LiAlH_4$ and $NaBH_4$. Michael addition. (mechanism not needed)

UNIT - V Organic Compounds – II **12 + 3**

Carboxylic Acids and their derivatives: Nomenclature, structure, preparation and reactions of acetic, Oxalic, benzoic, phthalic, salicylic acids. Physical properties, acidic nature, effect of substituent on acidic strength.

Preparations of aliphatic and aromatic acid chlorides and esters, amides and anhydrides. Claisen condensation, Reformatsky reactions, HVZ reaction, Hofmann

bromamide degradation and Curtius rearrangement. **Active methylene compounds:** Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate
Total Lecture & Tutorial Hours **75**

BOOKS FOR STUDY:

- B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., thirty three edition, 1992.
- P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & amp; Sons, twentieth edition, 2006.
- M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.

BOOKS FOR REFERENCES:

- Maron, S. H. and Prutton C. P. Principles of Physical Chemistry, 4thed.; The Macmillan Company: Newyork,1972.
- Lee, J. D. Concise Inorganic Chemistry, 4th ed.; ELBS William Heinemann: London,1991.
- S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.

WEB RESOURCES:

- **https://nptel.ac.in/courses/112102255** Thermodynamics
- **https://nptel.ac.in/courses/104101136** Advanced transition metal

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**								

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.	K1 to K4
CO2	discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.	K1 to K4
CO3	investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.	K1 to K4
CO4	discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.	K1 to K4
CO5	discuss the chemistry and named reactions related to carboxylic acids and their derivatives; discuss chemistry of active methylene compounds, halogen substituted acids and hydroxyl acids.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG M – MEDIUM L – LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems;	7	Chalk & Talk, ppt

	isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, expansion of ideal gase under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson co-efficient- inversion temperature.		
I	Thermochemistry - heats of reactions, standard states; types of heats of reactions; effect of temperature (Kirchhoff's equations); Hess's law and its applications; determination of bond energy; determination of calorific value of fuels Statement of Zeroth law of thermodynamics-Absolute Temperature scale.	**5**	**Chalk & Talk, ppt**
I	Solved problems	**3**	**Group discussion**
II	Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, calculation of entropy changes of an ideal gas and with changes in temperature, volume and pressure.	**4**	**Chalk & Talk, ppt**
II	Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships.	**4**	**Chalk & Talk, ppt**
II	Third law of thermodynamics - Nernst heat theorem and its applications; evaluation of absolute entropies from heat capacity measurements, exceptions to third law.	**4**	**Chalk & Talk, ppt**
II	Solved problems	**3**	**Group discussion**
III	Transition Elements- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. comparison of II and III transition series with I transition series. Metallurgy of Manganese, chromium and iron	**6**	**Chalk & Talk, ppt**
III	Solved Problems	**3**	**Group discussion**
IV	**Ethers:** Nomenclature, isomerism, general methods of preparations and reactions of diethyl ether. Zeisel's method of estimation of alkoxy group. Reactions of epoxides with alcohols, and $LiAlH_4$	**4**	**Chalk & Talk, ppt**
IV	**Thioethers:** nomenclature, structure, preparation,	**2**	**Chalk &**

	properties and uses of dimethyl sulphide.		**Talk, ppt**
IV	**Aldehydes and Ketones:** Nomenclature, structure, preparation, properties and reactivity of aliphatic and aromatic aldehydes and ketones (acetaldehyde, benzaldehyde, acetone & acetophenone); Reaction mechanisms - Aldol, Cannizzaro's, Perkin, Benzoin condensation and Knoevenagel reactions.	**4**	**Chalk & Talk, ppt**
IV	Baeyer - Villiger oxidation of ketones. Clemmensen reduction, Wolf - Kishner reduction, reduction with $LiAlH_4$ and $NaBH_4$. Michael addition. (mechanism not needed)	**2**	**Chalk & Talk, ppt**
IV	Solved Problems	**3**	**Group discussion**
V	**Carboxylic Acids and their derivatives:** Nomenclature, structure, preparation and reactions of acetic, Oxalic, benzoic, phthalic, salicylic acids. Physical properties, acidic nature, effect of substituent on acidic strength.	**5**	**Chalk & Talk, ppt**
V	Preparations of aliphatic and aromatic acid chlorides and esters, amides and anhydrides. Claisen condensation, Reformatsky reactions, HVZ reaction, Hofmann bromamide degradation and Curtius rearrangement.	**5**	**Chalk & Talk, ppt**
V	**Active methylene compounds:** Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate	**2**	**Chalk & Talk, ppt**
V	Solved Problems	**3**	**Group discussion**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	**Cos**	**K Level**	**Section A**		**Section B Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K4**	2	K1	2 (K2,K2)	2(K3,K3)
	CO2	**K1 – K4**	2	K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K4**	2	K1	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K4**	2	K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	**Section A (Multiple Choice Questions)**	**Section B (Either / Or Choice)**	**Section C (Either / Or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	**2**	**-**	**-**	**2**	**3.57**	**25**
	K2	**2**	**10**	**-**	**12**	**21.43**	
	K3	**-**	**10**	**16**	**26**	**46.43**	**46.43**
	K4	**-**	**-**	**16**	**16**	**28.57**	**28.57**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**
CIA II	**K1**	**2**	**-**	**-**	**2**	**3.57**	**25**
	K2	**2**	**10**	**-**	**12**	**21.43**	
	K3	**-**	**10**	**16**	**26**	**46.43**	**46.43**
	K4	**-**	**-**	**16**	**16**	**28.57**	**28.57**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1-K4	2	K1&K2	2 (K2)	2 (K3)
2	CO2	K1-K4	2	K1&K2	2 (K3)	2 (K4)
3	CO3	K1-K4	2	K1&K2	2 (K2)	2 (K3)
4	CO4	K1-K4	2	K1&K2	2 (K3)	2 (K4)
5	CO5	K1-K4	2	K1&K2	2 (K4)	2 (K3)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.57	21.43
K2	5	20	-	25	17.86	
K3	-	20	48	68	48.57	48.57
K4	-	10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K4**	
		OR		
15. b)	**Unit - V**	**CO5**	**K4**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K3**	
		OR		
20. b)	**Unit - V**	**CO5**	**K3**	

Course Name	PHYSICAL CHEMISTRY PRACTICAL – I			
Course Code	23UCHCP41	**L+T**	**P**	**C**
Category	CORE	-	3	3

COURSE OBJECTIVES:

This course aims at providing an understanding of

- the laboratory experiments in order to understand the concepts
- of physical changes in chemistry
- the rates of chemical reactions
- colligative properties
- adsorption isotherm

Chemical kinetics

1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate).
2. Determination of order of reaction between iodide and persulphate (initial rate method).
3. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar Thermochemistry
4. Determination of heat of neutralisation of a strong acid by a strong base.(demonstration)
5. Determination of heat of hydration of copper sulphate.

Electrochemistry – Conductance measurements

6. Determination of cell constant
7. Determination of molar conductance of strong electrolyte.
8. Determination of dissociation constant of acetic acid Colorimetry
9. Determination of concentration of copper sulphate solution (OD meter)

Colligative property & Adsorption

10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent
11. Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal.

Total Lecture Hours	**45**

BOOKS FOR REFERENCES:

- Sindhu, P.S.Practicals in Physical Chemistry, Macmillan India : New Delhi, 2005.
- Khosla, B. D.Garg,V. C.; Gulati, A.; Senior Practical Physical Chemistry, R.Chand : New Delhi, 2011.
- Gupta, Renu, Practical Physical Chemistry, 1st Ed.; New Age International: New Delhi, 2017.

WEB RESOURCES:

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

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL	
Changes Made in the Course	Percentage of Change	50	No Changes Made		New Course			

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	describe the principles and methodology for the practical work	**K1 to K4**
CO2	explain the procedure, data and methodology for the practical work.	**K1 to K4**
CO3	apply the principles of electrochemistry in doing experiments	**K1 to K4**
CO4	Execute kinetic experiments to find rate of a reaction	**K1 to K4**
CO5	demonstrate laboratory skills for safe handling of the equipment and chemicals	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	S	S	S	S	S	M
CO2	M	S	S	S	M	S	S	M
CO3	S	S	S	M	S	S	S	M
CO4	S	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	M

S- STRONG **M – MEDIUM** **L – LOW**

CO / PO MAPPING:					
COS	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**3**	**3**	**3**	**3**	**3**
CO 2	**3**	**3**	**3**	**3**	**3**
CO 3	**3**	**3**	**3**	**3**	**3**
CO 4	**3**	**3**	**3**	**3**	**3**
CO 5	**3**	**3**	**3**	**3**	**3**
WEIGHTAGE	**15**	**15**	**15**	**15**	**15**
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
	Chemical kinetics Experiments	**21**	**Demonstration & experiment**
	Electrochemistry – Conductance measurements	**15**	**Demonstration & experiment**
	Colligative property & Adsorption Experiments	**9**	**Demonstration & experiment**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	**Cos**	**K Level**	**Section A**		**Section B**	**Section C**
			MCQs			
			No. of. Questions	**K - Level**		
Model Exam	**CO1**	**K1 – K4**	**5**	**K1**		
	CO2	**K1 – K4**	**5**	**K2**		
	CO3	**K1 – K4**				**1(K4)**
	CO4	**K1 – K4**				**1 (K3)**
	CO5	**K1- K4**			**1 (K3)**	
Question Pattern Model exam		No. of Questions to be asked	**10**		**1**	**2**
		No. of Questions to be answered	**10**		**1**	**2**
		Marks for each question	**1**		**10**	**10**
		Total Marks for each section	**10**		**10**	**20**

Overall CIA marks(25) = (Model exam conducted for 60 marks is converted to 15 marks + regular class observation 10 marks)

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S.No	**COs**	**K - Level**	**Section A (MCQs)**		**Section B K - LEVEL**	**Section C K - LEVEL**
			No. of Questions	**K – Level**		
1	CO1	**K1 – K4**	**5**	**K1**		
2	CO2	**K1 – K4**	**5**	**K2**		
3	CO3	**K1 – K4**				1(K4)
4	CO4	**K1 – K4**				1(K3)
5	CO5	**K1 – K4**			**1 (K3)**	
No. of Questions to be Asked			**10**		**1**	**2**
No. of Questions to be answered			**10**		**1**	**2**
Marks for each question			**1**		**10**	**15**
Total Marks for each section			**10**		**10**	**30**
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Overall Summative Exam marks (75) = Exam marks (60) + Record marks (10) + viva (5)

Course Name	ALLIED PHYSICS – II			
Course Code	23UPHEA41	**L**	**P**	**C**
Category	ALLIED PAPER	4	-	4

COURSE OBJECTIVES:

- To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semiconductor physics, and electronics.

UNIT - I OPTICS **12**

Interference – interference in thin films – colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity

UNIT - II ATOMIC PHYSICS **12**

Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – photo electric effect – Einstein's photoelectric equation

UNIT - III NUCLEAR PHYSICS **12**

Nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses – controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor

UNIT - IV INTRODUCTION TO RELATIVITY **12**

Frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence

UNIT - V SEMICONDUCTOR PHYSICS **12**

P-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment)

Total Lecture Hours	**60**

BOOKS FOR STUDY:

- R.Murugesan (2005), Allied Physics, S.Chand & Co, New Delhi.
- K.Thangaraj and D.Jayaraman (2004), Allied Physics, Popular Book Depot, Chennai.
- Brijlal and N.Subramanyam (2002), Text book of Optics, S.Chand & Co, New Delhi.
- R.Murugesan (2005), Modern Physics, S.Chand & Co, New Delhi.
- A.Subramaniyam, Applied Electronics, 2nd Edn., National Publishing Co., Chennai.

BOOKS FOR REFERENCES:

- Resnick Halliday and Walker (2018), Fundamentals of Physics, 11th Edn., John Willey and Sons, Asia Pvt. Ltd., Singapore.
- D.R.Khanna and H.R. Gulati (1979). Optics, S.Chand & Co. Ltd., New Delhi.
- A.Beiser (1997), Concepts of Modern Physics, Tata McGraw Hill Publication, New Delhi.
- Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal Book Stall, New Delhi.
- V.K.Metha (2004), Principles of electronics, 6th Edn. , S.Chand and Company, New Delhi.

WEB RESOURCES:

- **https://www.berkshire.com/learningcenter/deltapfacemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?timcontinue=318&v=D38BjgUdL5U&feature=emb_logo**
- **https://www.youtube.com/watch?v=JrRrp5F-Qu4**
- **https://www.validyne.com/blog/leak-test-using-pressure-transducers/**
- **https://www.atoptics.co.uk/atoptics/blsky.htm -**
- **https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Explain the concepts of interference, diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns	**K1 to K4**
CO2	Outline the basic foundation of different atom models and various experiments establishing quantum concepts. Relate the importance of interpreting improving theoretical models based on observation. Appreciate inter disciplinary nature of science and in solar energy related applications.	**K1 to K4**
CO3	Summarize the properties of nuclei, nuclear forces, structure of atomic nucleus and nuclear models. Solve problems on delay rate half-life and mean-life. Interpret nuclear processes like fission and fusion.	**K1 to K4**
CO4	To describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and vice versa.	**K1 to K4**
CO5	Summarize the working of semiconductor devices like junction diode, Zener diode and power supplies that are practically used in daily life	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**
CO1	3	3	2	2	3	2	2	3	2	3
CO2	2	3	3	3	2	2	3	2	3	3
CO3	3	2	3	2	3	3	2	3	3	3
CO4	3	3	3	3	3	2	3	2	2	2
CO5	2	2	3	3	2	3	3	3	3	2
S- STRONG				**M – MEDIUM**					**L – LOW**	

CO / PO MAPPING:					
COS	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	3	1	3	-	2
CO 2	3	1	3	-	2
CO 3	3	1	3	-	2
CO 4	3	1	3	-	2
CO 5	3	1	3	-	2
WEIGHTAGE					
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS					

LESSON PLAN:			
UNIT	**COURSE NAME**	**HRS**	**PEDAGOGY**
I	Interference – interference in thin films – colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity	**12**	**Lecture method, PPT, Demonstration**
II	Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – photo electric effect – Einstein's photoelectric equation	**12**	**Lecture method, PPT, Demonstration**
III	Nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses – controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor	**12**	**Lecture method, PPT, Demonstration**
IV	Frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence	**12**	**Lecture method, PPT, Demonstration**
V	p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment)	**12**	**Lecture method, PPT, Demonstration**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	**Cos**	**K Level**	**Section A**		**Section B Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K4**	2	K1, K2	K1 OR K1	K3 OR K3
	CO2	**K1 – K4**	2	K1,K2	K2 OR K2	K4 OR K4
CI AII	**CO3**	**K1 – K4**	2	K1, K2	K2 OR K2	K3 OR K3
	CO4	**K1 – K4**	2	K1,K2	K3 OR K3	K4 OR K4
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	**Section A (Multiple Choice Questions)**	**Section B (Either / Or Choice)**	**Section C (Either / Or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	2	10	-	12	**21.43**	-
	K2	2	10	-	12	**21.43**	
	K3	-	-	16	16	**28.57**	**42.86**
	K4	-	-	16	16	**28.57**	**71.43**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**
CIA II	**K1**	2			2	**3.57**	-
	K2	2	10		12	**21.43**	
	K3		10	16	26	**46.43**	**25.00**
	K4			16	16	**28.57**	**71.43**
	Marks	**4**	**20**	**32**	**56**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1-K4	2	K1&K2	K1, K1	K2, K2
2	CO2	K1-K4	2	K1&K2	K2, K2	K2, K2
3	CO3	K1-K4	2	K1&K2	K2, K2	K3, K3
4	CO4	K1-K4	2	K1&K2	K3, K3	K3, K3
5	CO5	K1-K4	2	K1&K2	K4, K4	K4, K4
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.57	21.43
K2	5	20	-	25	17.86	
K3	-	20	48	68	48.57	48.57
K4	-	10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K1**	
		OR		
11. b)	**Unit - I**	**CO1**	**K1**	
12. a)	**Unit - II**	**CO2**	**K2**	
		OR		
12. b)	**Unit - II**	**CO2**	**K2**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K4**	
		OR		
15. b)	**Unit - V**	**CO5**	**K4**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K2**	
		OR		
16. b)	**Unit - I**	**CO1**	**K2**	
17. a)	**Unit - II**	**CO2**	**K2**	
		OR		
17. b)	**Unit - II**	**CO2**	**K2**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K3**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	ALLIED PHYSICS PRACTICAL – II			
Course Code	23UPHEP41	**L+T**	**P**	**C**
Category	ALLIED PRACTICAL	-	2	2

COURSE OBJECTIVES:

- Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

SEMESTER - I LIST OF EXPERIMENTS

Minimum of Eight Experiments from the list:

1. Radius of curvature of lens by forming Newton's rings
2. Thickness of a wire using air wedge
3. Wavelength of mercury lines using spectrometer and grating
4. Refractive index of material of the lens by minimum deviation
5. Refractive index of liquid using liquid prism
6. Determination of AC frequency using sonometer
7. Specific resistance of a wire using PO box
8. Thermal conductivity of poor conductor using Lee's disc
9. Determination of figure of merit table galvanometer
10. Determination of Earth's magnetic field using field along the axis of a coil
11. Characterisation of Zener diode
12. Construction of Zerner/IC regulated power supply
13. Construction of AND, OR, NOT gates using diodes and transistor
14. NOR gate as a universal building block

Note : Use of digital balance permitted

Total Lecture Hours	**30**

BOOKS FOR STUDY:

- Srinivasan.M.N., Balasubramanian.S., Ranganathan.R., A Text Book of Practical Physics, 2017 Edition, Sultan Chand & Sons

BOOKS FOR REFERENCES:

- Ouseph.C., Practical Physics and Electronics, 2013, S.Viswanathan.P.Ltd.
- Practical Physics and Electronics, C.C.Ouseph, U.J.Rao, V.Vijayendran, S.Viswanathan Publishers (2007)

WEB RESOURCES:

- **https://nptel.ac.in/course.html/physics/experimental physics I, II and III**
- **https://nptel.ac.in/courses/115/105/115105110/**
- **https://www.youtube.com/playlist?list=PLuiPz6iU5SQ8-rZn_LgLofRX7n8z4tHYK**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Remembering the Aim and apparatus used in the experiment	**K1 to K4**
CO2	Understanding of laws and formulas of the experiment	**K1 to K4**
CO3	Applying the knowledge to do the experiment	**K1 to K4**
CO4	Calculating and examining the aim of the experiment	**K1 to K4**
CO5	Interpreting the result of the experiment	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**
CO1	3	3	1	1	2	3	3	3	1	3
CO2	3	3	2	2	2	3	3	3	1	3
CO3	3	3	3	3	3	3	3	3	2	3
CO4	3	3	2	3	3	3	3	3	1	3
CO5	3	3	2	2	2	3	3	3	1	3
S- STRONG			**M – MEDIUM**					**L – LOW**		

CO / PO MAPPING:					
COS	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**3**	**2**	**3**	**-**	**2**
CO 2	**3**	**2**	**3**	**-**	**2**
CO 3	**3**	**2**	**3**	**-**	**2**
CO 4	**3**	**2**	**3**	**-**	**2**
CO 5	**3**	**2**	**3**	**-**	**2**
WEIGHTAGE					
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS					

LESSON PLAN:

SEM	ALLIED PHYSICS PRACTICALS – II	HRS	PEDAGOGY
II	1. Radius of curvature of lens by forming Newton's rings 2. Wavelength of mercury lines using spectrometer and grating 3. Determination of AC frequency using sonometer 4. Thermal conductivity of poor conductor using Lee's disc 5. Determination of figure of merit table galvanometer 6. Characterisation of Zener diode 7. Construction of Zerner regulated power supply 8. NOR gate as a universal building block	**30**	**Demonstration and Video**

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total
25	75	100

Record Note and Attendance -10 mark
Model examination - 15 mark
Total CIA - 25 mark
Model examination should be conducted for 30 mark and it has to be converted to 15 mark

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	**Cos**	**K Level**	**No. of. Questions**	**K - Level**
CIA-I	**CO1 - CO5**	**K1 – K4**	**1** Question for Each Student	**K1 – K4**
Question Pattern CIA - I		No. of Questions to be asked	**1** Question for Each Student	
		No. of Questions to be answered	**1**	
		Marks for each question	**30**	
		Total Marks for each section	**30**	

Distribution of Marks with COs & K Level for Correction of CIA I				
	COs	**Distribution of the work of the experiment**	**K - Level**	**MARKS**
CIA I	**CO1**	Aim and apparatus	**K1**	**2.0**
	CO3	Formula and Tabular Column	**K2**	**5.0**
	CO5	Understanding and Observation	**K4**	**12.0**
	CO4	Calculation and Graph	**K3**	**8.0**
	CO2	Interpretation of result	**K1**	**3.0**
	Total Marks			**30**

Distribution of Marks with K Level CIA I					
	K Level	**Distribution of the work of the experiment**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	Aim and apparatus	5	16.67	-
	K2	Formula and Tabular Column Interpretation of result	5	16.67	
	K3	Calculation and Graph	8	26.66	**33.34**
	K4	Understanding and Observation	12	40.00	**60.00**
	Marks		**30**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)			
COs	**K - Level**	**No. of Questions**	**K – Level**
CO1 - CO5	**K1 – K4**	**1** Question for Each Student	**K1 – K4**
No. of Questions to be Asked		**1** Question for Each Student	
No. of Questions to be answered		**1**	
Marks for each question		**75**	
Total Marks for each section		**75**	
(Figures in parenthesis denotes, questions should be asked with the given K level)			

Distribution of Marks with COs & K Level for Correction of the Summative Exam			
COs	**Distribution of the work of the experiment**	**K - Level**	**MARKS**
CO1	Aim and apparatus	**K1**	**5**
CO3	Formula and Tabular Column	**K2**	**15**
CO5	Understanding and Observation	**K4**	**30**
CO4	Calculation and Graph	**K3**	**20**
CO2	Interpretation of result	**K1**	**5**
Total Marks			**75**

Distribution of Marks with K Level				
K Level	**Parameters for K-Level**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	Aim and apparatus	**10**	**13.33**	**-**
K2	Formula and Tabular Column, Interpretation of result	**15**	**20.00**	**13.33**
K3	Calculation and Graph	**20**	**26.67**	**33.33**
K4	Understanding and Observation	**30**	**40.00**	**60.00**
Marks		**75**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				

Course Name	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS			
Course Code	23UCHSC41	**L**	**P**	**C**
Category	SKILL ENHANCEMENT COURSE	2	-	2

COURSE OBJECTIVES:

This course aims at providing an overall view of the

- operation and troubleshooting of chemical instruments
- fundamentals of analytical techniques and its application in the characterization of compounds
- theory of chromatographic separation
- theory of thermo / electro analytical techniques
- stoichiometry and the related concentration terms

UNIT - I Qualitative and Quantitative Aspects of Analysis 6

S.I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids.

Stoichiometry Calculations

Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q-test, F-test, T-test. The Least Square Method for Deriving Calibration plots.

UNIT - II Atomic Absorption Spectroscopy: 6

Basic principles of instrumentation, (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

UNIT - III UV-Visible and IR Spectroscopy	6
Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. UV-Visible Spectrometry: Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Interpretation of the 10^{-3} M solution of $CuSO_4$. Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques Interpretation of the Benzoic acid, aniline and urea IR spectra (database).	
UNIT - IV Thermal and Electro-analytical Methods of Analysis	**6**
TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate, calcium acetate and Nylon 6.6 First derivative of TGA (DTG). DSC- Principle, Instrumentation and applications. Glass transition temperature T_g. Electroanalytical methods: polarography - principle, instrumentation and applications. Cyclic Voltammetry – instrumentation and principle. Differential pulse voltammetry (DPV) and Amperometry - Applications.	
UNIT - V Separation and purification techniques	**6**
Solvent Extraction - principle– Liquid - Liquid Extraction Chromatography: Adsorption -Column, TLC, Partition-Paper, Ion exchange- Gas chromatography (GC), High performance liquid chromatography (HPLC) Principle and working technique. Rf value and its significance.	
Total Lecture Hours	**30**

BOOKS FOR STUDY:

- Gurdeep. R. Chatwal, Sham. K. Anand, Instrumental methods of Chemical Analysis, Himalaya Publishing House Fifth edition, Reprint, Delhi, 2008.
- R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007.

BOOKS FOR REFERENCES:

- B. K. Sharma, Instrumental methods of Chemical Analysis, Goel Publishing House, 27th Edition, Meerat, 2011.
- Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011.

WEB RESOURCES:

- http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf
- http://eric.ed.gov/?id=EJ386287
- http://www.sjsu.edu/faculty/watkins/diamag.htm
- http://www.britannica.com/EBchecked/topic/108875/separation-and-purification
- http://www.chemistry.co.nz/stoichiometry.htm

Nature of Course	EMPLOYABILITY			SKILL ORIENTED	✓		ENTREPRENEURSHIP					
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL			GLOBAL	✓			
Changes Made in the Course	Percentage of Change			No Changes Made			New Course	✓				
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**												

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry	**K1 & K2**
CO2	explain theory, instrumentation and application of UV visible and Infrared spectroscopy.	**K1 & K2**
CO3	able to discuss instrumentation, theory and applications of thermal and electrochemical techniques	**K1 & K2**
CO4	explain the use of chromatographic techniques in the separation and identification of mixtures	**K1 & K2**
CO5	explain preparation of solutions, stoichiometric calculations	**K1 & K2**

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**
CO1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**		
CO2	**M**	**S**	**S**	**S**	**M**	**S**	**S**	**M**		
CO3	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**M**		
CO4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**		
CO5	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**M**		
S- STRONG				**M – MEDIUM**					**L – LOW**	

CO / PO MAPPING:					
COS	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**3**	**3**	**3**	**3**	**3**
CO 2	**3**	**3**	**3**	**3**	**3**
CO 3	**3**	**3**	**3**	**3**	**3**
CO 4	**3**	**3**	**3**	**3**	**3**
CO 5	**3**	**3**	**3**	**3**	**3**
WEIGHTAGE	**15**	**15**	**15**	**15**	**15**
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**

LESSON PLAN:

UNIT	COURSE NAME	HRS	PEDAGOGY
I	S.I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q-test, F-test, T-test. The Least Square Method for Deriving Calibration	**6**	**Chalk & talk**
II	Basic principles of instrumentation, (choice of source, monochromator, detector, choice of flame and Burnerdesigns. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.	**6**	**Chalk & talk, videos**
III	Origin of spectra, interaction of radiation with matter, fundamental laws of spetroscopy and selection rules, validity of Beer-Lambert's law. UV-Visible Spectrometry: Basic principles, instrumentation	**6**	**Ppt , Chalk & talk, videos**

	(choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Interpretation of the 10^{-3} M solution of $CuSO_4$. Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques Interpretation of the Benzoic acid, aniline and urea IR spectra (database).		
IV	TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate, calcium acetate and Nylon 6.6 First derivative of TGA (DTG). DSC- Principle, Instrumentation and applications. Glass transition temperature T_g. Electroanalytical methods: polarography - principle, instrumentation and applications. Cyclic Voltammetry – instrumentation and principle. Differential pulse voltammetry (DPV) and Amperometry - Applications.	**6**	**Ppt , Chalk & talk, videos**
V	Solvent Extraction - principle– Liquid - Liquid Extraction Chromatography: Adsorption -Column, TLC, Partition-Paper, Ion exchange- Gas chromatography (GC), High performance liquid chromatography (HPLC) Principle and working technique. Rf value and its significance.	**6**	**Ppt , Chalk & talk, videos**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	**Cos**	**K Level**	**Section A**	
			MCQs	
			No. of. Questions	**K - Level**
CI AI	**CO1**	**K1 – K2**	**25**	**K1,K2**
	CO2	**K1 – K2**	**25**	**K1,K2**
CI AII	**CO3**	**K1 – K2**	**25**	**K1,K2**
	CO4	**K1 – K2**	**25**	**K1,K2**
Question Pattern CIA I & II		**No. of Questions to be asked**	**50**	
		No. of Questions to be answered	**50**	
		Marks for each question	**1**	
		Total Marks for each section	**50**	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (Ist Test-2 CO's & IInd Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	**30**	**30**	**60**	**100**
	K2	**20**	**20**	**40**	
	K3				
	K4				
	Marks	**50**	**50**	**100**	**100**
CIA II	**K1**	**30**	**30**	**60**	**100**
	K2	**20**	**20**	**40**	
	K3				
	K4				
	Marks	**50**	**50**	**100**	**100**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	**COs**	**K - Level**	**Section A (MCQs)**	
			No. of Questions	**K – Level**
1	**CO1**	**K1-K2**	**15**	**K1,K2**
2	**CO2**	**K1-K2**	**15**	**K1,K2**
3	**CO3**	**K1-K2**	**15**	**K1,K2**
4	**CO4**	**K1-K2**	**15**	**K1,K2**
5	**CO5**	**K1-K2**	**15**	**K1,K2**
No. of Questions to be Asked			**75**	
No. of Questions to be answered			**75**	
Marks for each question			**1**	
Total Marks for each section			**75**	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**40**	**40**	**53**	**100**
K2	**35**	**35**	**47**	
K3				
K4				
Marks		**75**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				

Course Name	FORENSIC SCIENCE			
Course Code	23UCHSC42	**L**	**P**	**C**
Category	SKILL ENHANCEMENT COURSE	1	-	1

COURSE OBJECTIVES:

This course aims at providing an overall view of the

- Poisons and its types
- crime detection through analytical instruments
- forgery and its detection
- tracks and traces of crime
- medical aspects involved

UNIT - I Poisons **3**

Poisons - types and classification - diagnosis of poisons in the living and the dead - clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons

UNIT - II Crime Detection **3**

Accidental explosion during manufacture of matches and fireworks Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns

UNIT - III Forgery and Counterfeiting **3**

Documents - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays -comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using AAS to detect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond

UNIT - IV Tracks and Traces **3**

Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints - residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair – Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.

UNIT - V Medical Aspects	6
Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum – Gas chromatography- Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms –laboratory examination of barrel washing and detection of powder residue by chemical tests.	
Total Lecture Hours	**15**

BOOKS FOR STUDY:

- SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011.
- Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press, Taylor & Francis Group, 2019.

BOOKS FOR REFERENCES:

- Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition,2003
- Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014.
- Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley - Blackwell, first edition, 2015

WEB RESOURCES:

- **http://www.library.ucsb.edu/ist/03-spring/internet.html**
- **http://www.wonder howto.com/topic/forensic-science/**

Nature of Course	EMPLOYABILITY			SKILL ORIENTED	✓		ENTREPRENEURSHIP					
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		✓	GLOBAL				
Changes Made in the Course	Percentage of Change			No Changes Made			New Course	✓				

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	learn about the Poisons - types and classification of poisons in the living and the dead organisms and also get information about Postmortem.	K1 & K2
CO2	get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices and other security measures for VVIP - composition of bullets and detecting powder burns	K1 & K2
CO3	detect the forgery documents, different types of forged signatures	K1 & K2
CO4	have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies	K1 & K2
CO5	get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.	K1 & K2

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	S	S	S	S	S	S	S	M		
CO2	M	S	S	S	M	S	S	M		
CO3	S	S	S	M	S	S	S	M		
CO4	S	S	S	S	S	S	S	M		
CO5	S	M	S	S	S	S	S	M		
S- STRONG			M – MEDIUM					L – LOW		

CO / PO MAPPING:					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:			
UNIT	**COURSE NAME**	**HRS**	**PEDAGOGY**
I	Poisons - types and classification - diagnosis of poisons in the living and the dead -clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.	**3**	**Chalk & talk, ppt**
II	Accidental explosion during manufacture of matches and fireworks Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns.	**3**	**Chalk & talk, ppt**
III	Documents - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays - comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using AAS to detect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.	**3**	**Chalk & talk, ppt**
IV	Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints -residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair – Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.	**3**	**Chalk & talk, ppt**
V	Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum – Gas chromatography- Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms –laboratory examination of barrel washing and detection of powder residue by chemical tests.	**3**	**Chalk & talk, ppt**

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	**Cos**	**K Level**	**Section A**	
			MCQs	
			No. of. Questions	**K - Level**
CI AI	**CO1**	**K1 – K2**	**25**	**K1,K2**
	CO2	**K1 – K2**	**25**	**K1,K2**
CI AII	**CO3**	**K1 – K2**	**25**	**K1,K2**
	CO4	**K1 – K2**	**25**	**K1,K2**
Question Pattern CIA I & II		**No. of Questions to be asked**	**50**	
		No. of Questions to be answered	**50**	
		Marks for each question	**1**	
		Total Marks for each section	**50**	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (Ist Test-2 CO's & IInd Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	Section A (Multiple Choice Questions)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100
CIA II	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	COs	K - Level	Section A (MCQs)	
			No. of Questions	K – Level
1	CO1	K1-K2	15	K1,K2
2	CO2	K1-K2	15	K1,K2
3	CO3	K1-K2	15	K1,K2
4	CO4	K1-K2	15	K1,K2
5	CO5	K1-K2	15	K1,K2
No. of Questions to be Asked			75	
No. of Questions to be answered			75	
Marks for each question			1	
Total Marks for each section			75	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	**Section A (Multiple Choice Questions)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**40**	**40**	**53**	**100**
K2	**35**	**35**	**47**	
K3				
K4				
Marks		**75**	**100**	**100**
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				