B.Sc., CHEMISTRY

Syllabus

Program Code: UCH

2024 - 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 2024-2025 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 / 24UMBEA12	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 / 24UMBEA22	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

J.J.Thomson and Rutherford atomic model Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; 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;

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

Classical mechanics – Introduction - 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 (one dimensional) - 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 and Pauling's electronegativity scale.

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–Ion polarisation – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds.

Covalent bond

Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency – hybridization – sp, sp^2 and sp^3; VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7. Applications of dipole moment in polarity, degree of polarity, Shape, Ionic character of the molecule.

UNIT - IV STRUCTURE AND BONDING – II 12+3

VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species $–CO_3^{2-}$, NO_3^- ; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, O_2, O_2^+, O_2^{2-}, N_2, CO; 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 and Hydrogen bonding – Types, special properties of water, ice, stability of DNA.

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; stability of carbocations, carbanions and free radicals; reaction intermediates – carbanions, carbocations, free radicals.

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,

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

Total Lecture & Tutorial Hours	75

BOOKS FOR STUDY:

- Madan, R. D. and Sathya Prakash, *Modern Inorganic Chemistry,* 2nded.; 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.
- Arun bahl and B.S. Bahl. Text book of organic chemistry, S. Chand Publishing House, 2019.
- 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	J.J.Thomson and Rutherford atomic model Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; 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;	6	Chalk & talk
	Discussion on Questions related to the above topics, from various competitive examinations	3	Group discussion & inquiry
II	Classical mechanics – Introduction - 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 (one dimensional) - significance of Ψ and Ψ^2.	6	Chalk & talk
	Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization	6	Chalk & talk, animation

	energy, electron affinity, electronegativity and Pauling's electronegativity scale.		**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—Ion polarisation – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds.	**6**	**Chalk & talk, ppt**
	Covalent bond Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency – hybridization – sp, sp^2 and sp^3; VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7. Applications of dipole moment in polarity, degree of polarity, Shape, Ionic character of the molecule.	**6**	**Chalk & talk, ppt**
	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 $–CO_3^{2-}$, NO_3^- ; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, O_2, O_2^+, O_2^{2-}, N_2, CO; comparison of VB and MO theories.	**6**	**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. Weak Chemical Forces - Vander Waals forces, ion-dipol forces, dipole-dipole interactions and Hydrogen bonding - Types, special properties of water, ice, stability of DNA.	**6**	**Chalk & talk, ppt**
	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; stability of carbocations, carbanions and free radicals; reaction intermediates – carbanions, carbocations, free radicals.	**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,	**5**	**Chalk & talk**
	Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane.	**3**	**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	4		2	2

	be answered				
	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	24UMBEA12	**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. Monohybri 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. (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	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	24UMBEA22	**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 PLANT AND ITS PARTS: 12

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 INTRODUCTION TO TAXONOMY AND SYSTEMATICS: 12

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 TISSUE AND TISSUE SYSTEMS: 12

Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.

UNIT - IV PLANT MICROBE INTERACTIONS: 12

Pathogenesis, mechanism of pathogen transmission, establishment and symptoms. plant diseases caused by bacteria – *Xanthomonas*, Fungi – *Fusarium* and Viruses - TMV.

UNIT - V BIOFERTILIZERS: 12

Definition – advantage of biofertilizers, Bacterial biofertilizers – Rhizobium , Fungal Biofertilizers – Mycorrhiza , Algal biofertilizer – Cholera , Application methods of biofertilizers – seed inoculation , soil inoculation . soil application root dip.

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	12	PPT/CHALK AND TALK

	Kingdom, Division, Class, Order, Family, Genus and species.		
III	Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and 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.dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.	**12**	**PPT/CHALK AND TALK**
IV	Plant microbe interactions – Pathogenesis, mechanism of pathogen transmission , establishment and symptoms . plant diseases caused by bacteria – Xanthomonas , fungi – fusarium and viruses . TMV	**12**	**PPT/CHALK AND TALK**
V	Biofertilizer - Definition – advantage of biofertillizers , Bacterial biofertilizers – Rhizobium , Fungal Biofertilizers – Mycorrhiza , Algal biofertilizer – Cholera , Application methods of biofertilizers – seed inoculation , soil inoculation . soil application root dip.	**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**
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	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.				