B.Sc., CHEMISTRY

Syllabus

Program Code: UCH

2024 - Onwards

MANNAR THIRUMALAI NAICKER COLLEGE

(AUTONOMOUS)

Re-accredited with "A+" Grade by NAAC

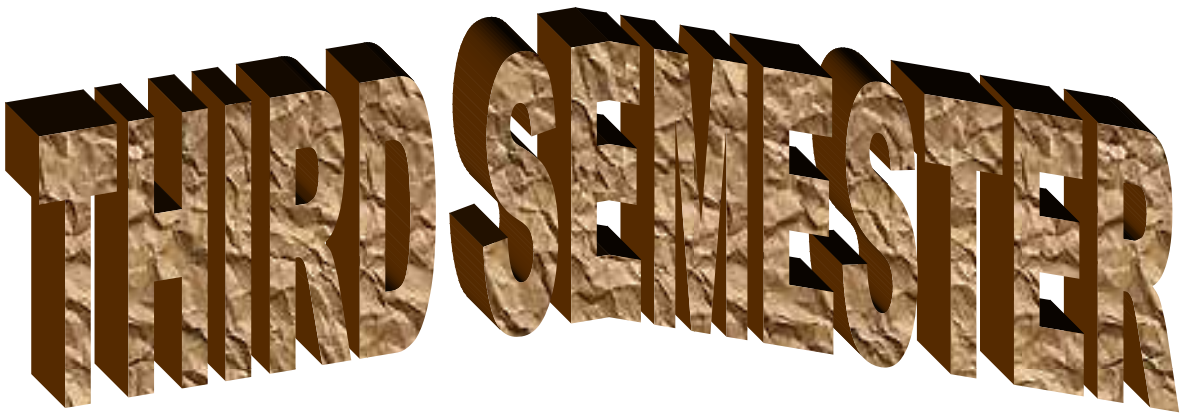
PASUMALAI, MADURAI – 625 004

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
THIRD SEMESTER						
Part – I	**Tamil / Alternative course**					
23UTAGT31	தமிழக வரலாறும் பண்பாடும்	6	3	25	75	100
Part – II	**English**					
23UENGE31	General English - III	6	3	25	75	100
Part - III	**Core courses**					
23UCHCC31	General Chemistry - III	5	5	25	75	100
23UCHCP31	Qualitative Inorganic Analysis	3	2	25	75	100
Part - III	**Elective courses**					
23UPHEA31	Allied Physics - I	4	4	25	75	100
23UPHEP31	Allied Physics Practical - I	2	2	25	75	100
Part - IV	**Skill Based courses**					
23UCHSC31	Pesticide Chemistry	2	2	25	75	100
23UCHSC32	Entrepreneurial Skills in Chemistry	1	1	25	75	100
Part - IV	**Mandatory course**					
23UEVSG41	Environmental Studies	1	-	-	-	-
	Total	30	22	200	600	800
FOURTH SEMESTER						
Part – I	**Tamil / Alternative course**					
23UTAGT41	தமிழும் அறிவியலும்	6	3	25	75	100
Part – II	**English**					
23UENGE41	General English - IV	6	3	25	75	100
Part - III	**Core courses**					
23UCHCC41	General Chemistry - IV	5	5	25	75	100
23UCHCP41	Physical Chemistry Practical - I	3	3	25	75	100
Part - III	**Elective courses**					
23UPHEA41	Allied Physics - II	4	4	25	75	100
23UPHEP41	Allied Physics Practical - II	2	2	25	75	100
Part - IV	**Skill Based courses**					
23UCHSC41	Instrumental Methods Of Chemical Analysis	2	2	25	75	100
23UCHSC42	Forensic Science	1	1	25	75	100
Part - IV	**Mandatory Course**					
23UEVSG41	Environmental Studies	1	2	25	75	100
	Total	30	25	225	675	900


THIRD SEMESTER

Course Name	General Chemistry - III			
Course Code	23UCHCC31	**L+T**	**P**	**C**
Category	Core	4+1	-	5

COURSE OBJECTIVES:

This course aims to provide a comprehensive knowledge on

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

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

Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell –Boltzmann distribution of speed of molecules- average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases (definitions alone).

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

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

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

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

Crystals: Crystals –size and shape; laws of crystallography; symmetry elements – plane, centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg's equation (derivation)

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

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

Natural radioactivity -α, β and γ rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability – neutron-proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series.

Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems from half life period, radiocarbon dating and binding energy) Applications of radioactive isotopes.

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

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

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

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

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

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

UNIT - V Phenols **12+3**

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

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

Thiol: preparation and uses of ethyl mercaptan.

Total Lecture & Tutorial Hours	**75**

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

amp; Sons, twentieth edition, 2006.

WEB RESOURCES:

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

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

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

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	explain the kinetic properties of gases by using mathematical concepts.	**K1 to K4**
CO2	describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations.	**K1 to K4**
CO3	investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management.	**K1 to K4**
CO4	write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.	**K1 to K4**
CO5	investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:

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

S- STRONG **M – MEDIUM** **L – LOW**

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

LESSON PLAN:

UNIT	General Chemistry - III	HRS	PEDAGOGY
I	Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell – Boltzmann distribution of speed of molecules- average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases (definitions alone).	**6**	**Chalk & talk, ppt**
	Real gases: Deviations from ideal gas behaviour; compressibility factor, Z. equations of states for real gases- van der Waal's equation; Numerical problems based on equations of states for real gases, isotherms of real gases – critical phenomena – isotherms of CO_2 liquefaction-of gases;	**6**	**Chalk & talk, ppt**
I	Solved problems	**3**	**Group discussion**
II	Liquid State: Properties of Liquids- Surface tension, viscosity and their applications. Liquid crystals – classification and applications.	**3**	**Chalk & talk, ppt**
II	Solid State: Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism.	**3**	**Chalk & talk, ppt**
II	Crystals: Crystals –size and shape; laws of crystallography; symmetry elements – plane, centre and axis; Miller indices,	**3**	**Chalk & talk, ppt**

	unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg's equation (derivation)		
II	Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; Defects in solids - stoichiometric and nonstoichiometric defects.	**3**	**Chalk & talk, ppt**
II	Solved problems	**3**	**Group discussion**
III	Natural radioactivity -α, β and γ rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability – neutron-proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series	**6**	**Chalk & talk, ppt**
III	Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems from half life period, radiocarbon dating and binding energy) Applications of radioactive isotopes.	**3**	**Chalk & talk, ppt**
III	Nuclear energy; nuclear fission and fusion (definition and differences) – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.	**3**	**Chalk & talk, ppt**
III	Solved problems	**3**	**Group discussion**
IV	**Aliphatic halogen derivatives:** Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – SN_1, SN_2 and SN_i mechanisms with stereochemical aspects and effect of solvent. preparation, properties and applications of $CHCl_3$ and CCl_4	**4**	**Chalk & talk, ppt**
IV	**Aromatic halogen compounds:** Nomenclature - preparation, properties and uses of Chlorobenzene, Mechanism of nucleophilic aromatic substitution – benzyne intermediate.	**4**	**Chalk & talk, ppt**
IV	**Aryl alkyl halides:** Nomenclature, benzyl chloride – preparation – properties and uses **Alcohols:** Nomenclature, classification, preparation, properties, uses of ethanol; test for hydroxyl groups.	**4**	**Chalk & talk, ppt**

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

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

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

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

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

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

Summative Examinations - Question Paper – Format

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

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

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

Course Name	Qualitative Inorganic Analysis			
Course Code	23UCHCP31	**L+T**	**P**	**C**
Category	Core	-	3	2

COURSE OBJECTIVES:

This course aims at providing skill on

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

Semi-micro qualitative inorganic analysis:

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

Total Lecture Hours	**45**

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

MAPPING WITH PROGRAM OUTCOMES:

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

S- STRONG **M – MEDIUM** **L – LOW**

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

LESSON PLAN:

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

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

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

Internal Examinations - Question Paper – Format

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

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

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

Summative Examinations - Question Paper – Format

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

10 marks to be awarded for proper record submission.

Course Name	Allied Physics – I			
Course Code	23UPHEA31	**L**	**P**	**C**
Category	Allied Paper	4	-	4

COURSE OBJECTIVES:

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

UNIT - I WAVES, OSCILLATIONS AND ULTRASONICS 12

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

UNIT - II PROPERTIES OF MATTER 12

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

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

Surface tension: definition – molecular theory – droplets formation.

UNIT - III HEAT AND THERMODYNAMICS 12

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

UNIT - IV ELECTRICITY AND MAGNETISM 12

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

UNIT - V DIGITAL ELECTRONICS 12

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

Total Lecture & Tutorial Hours 60

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

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

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

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

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

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

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

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

Summative Examinations - Question Paper – Format

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

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

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

Course Name	Allied Physics Practical – I			
Course Code	23UPHEP31	**L+T**	**P**	**C**
Category	Allied Practical	-	2	2

COURSE OBJECTIVES:

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

SEMESTER - I LIST OF EXPERIMENTS

Minimum of Eight Experiments from the list:

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

Note : Use of digital balance permitted

Total Lecture Hours	**30**

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

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

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

LESSON PLAN:

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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total
25	**75**	**100**

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

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

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

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

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

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

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

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

Course Name	Pesticide Chemistry			
Course Code	23UCHSC31	**L**	**P**	**C**
Category	Skill Enhancement Course	2	-	2

COURSE OBJECTIVES:

This course aims to providing the students

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

UNIT - I Introduction to pesticides and Toxicity of Pesticides 06

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

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

UNIT - II Insecticides 06

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

UNIT - III Pesticides residues 06

Pesticides residues in atmosphere- entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water - entry into water systems, action and effect in aquatic environment. Pesticides residues in soil- entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility, decomposition and degradation by climatic factors and microorganism.

UNIT - IV Pesticide Residues effect and analysis 06

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

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

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

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

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

LESSON PLAN:			
UNIT	**Pesticide Chemistry**	**HRS**	**PEDAGOGY**
I	Overview of Pesticides, Chemistry of Pesticides: classes of pesticides - chemical targets, structures, chemical names, physical and chemical properties. Toxicity of pesticides: Acute and chronic toxicity in mammals, birds, aquatic species. Methods of analysis of pesticides (AAS, NMR NAA).	**6**	**Chalk & talk, ppt**
II	Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses and toxicity; Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl and Propoxur.	**6**	**Chalk & talk, ppt**
III	Pesticides residues in atmosphere- entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water - entry into water systems, action and effect in aquatic environment. Pesticides residues in soil. entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility, decomposition and degradation by climatic factors and microorganism.	**6**	**Chalk , ppt& talk**
IV	Effects of pesticides residue on human life, birds and animals- routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues- sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.	**6**	**Chalk & talk, ppt**
V	Attractants and repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone. Comparison between biopesticides and chemical pesticides.	**6**	**Chalk & talk, ppt**

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

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (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	Entrepreneurial Skills in Chemistry			
Course Code	23UCHSC32	**L**	**P**	**C**
Category	Skill Enhancement Course	1	-	1

COURSE OBJECTIVES:

The course aims at providing training to

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

UNIT - I Food Chemistry **03**

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

UNIT - II Food Additives **03**

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

UNIT - III Dyes **03**

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

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

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

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

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

Total Lecture & Tutorial Hours **15**

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

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

LESSON PLAN:

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

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

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

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

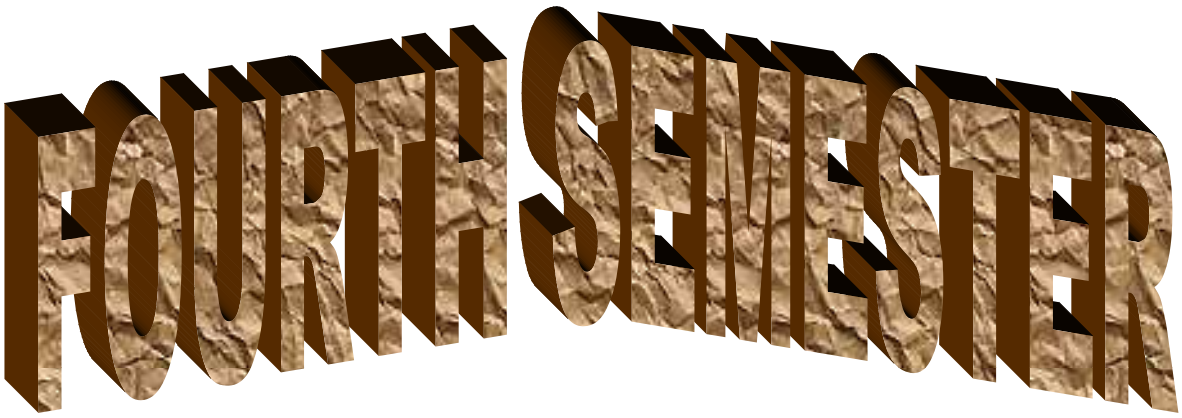
K4- Examining, analyzing, presentation and make inferences with evidences

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

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

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

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


FOURTH SEMESTER

Course Name	General Chemistry - IV			
Course Code	23UCHCC41	**L + T**	**P**	**C**
Category	Core	4 + 1	-	5

COURSE OBJECTIVES:

This course aims to provide a comprehensive knowledge on

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

MAPPING WITH PROGRAM OUTCOMES:

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

S- STRONG M – MEDIUM L – LOW

CO / PO MAPPING:

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

LESSON PLAN:

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

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

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

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

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

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

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

Summative Examinations - Question Paper – Format

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

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

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

Course Name	Physical Chemistry Practical – I			
Course Code	23UCHCP41	**L+T**	**P**	**C**
Category	Core	-	3	3

COURSE OBJECTIVES:

This course aims at providing an understanding of

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

Chemical kinetics

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

Electrochemistry – Conductance measurements

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

Colligative property & Adsorption

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

Total Lecture Hours	**45**

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

MAPPING WITH PROGRAM OUTCOMES:

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

S- STRONG **M – MEDIUM** **L – LOW**

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

LESSON PLAN:

UNIT	Physical Chemistry Practical – I	HRS	PEDAGOGY
	Chemical kinetics Experiments	**21**	**Demonstration & experiment**
	Electrochemistry – Conductance measurements	**15**	**Demonstration & experiment**
	Colligative property & Adsorption Experiments	**9**	**Demonstration & experiment**

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

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

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

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

Course Name	Allied Physics – II			
Course Code	23UPHEA41	**L**	**P**	**C**
Category	Allied Paper	4	-	4

COURSE OBJECTIVES:

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

UNIT - I OPTICS **12**

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

UNIT - II ATOMIC PHYSICS **12**

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

UNIT - III NUCLEAR PHYSICS **12**

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

UNIT - IV INTRODUCTION TO RELATIVITY **12**

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

UNIT - V SEMICONDUCTOR PHYSICS **12**

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

Total Lecture Hours **60**

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

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

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

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

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

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

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

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

Summative Examinations - Question Paper – Format

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

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

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

Course Name	Allied Physics Practical – II			
Course Code	23UPHEP41	**L+T**	**P**	**C**
Category	Allied Practical	-	2	2

COURSE OBJECTIVES:

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

SEMESTER - I LIST OF EXPERIMENTS

Minimum of Eight Experiments from the list:

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

Note : Use of digital balance permitted

Total Lecture Hours	**30**

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	3	3	1	1	2	3	3	3	1	3
CO2	3	3	2	2	2	3	3	3	1	3
CO3	3	3	3	3	3	3	3	3	2	3
CO4	3	3	2	3	3	3	3	3	1	3
CO5	3	3	2	2	2	3	3	3	1	3

S- STRONG **M – MEDIUM** **L – LOW**

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

LESSON PLAN:

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

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total
25	75	100

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

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

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

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

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

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

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

Course Name	Instrumental Methods of Chemical Analysis			
Course Code	23UCHSC41	**L**	**P**	**C**
Category	Skill Enhancement Course	2	-	2

COURSE OBJECTIVES:

This course aims at providing an overall view of the

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

UNIT - I Qualitative and Quantitative Aspects of Analysis 6

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

Stoichiometry Calculations

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

UNIT - II Atomic Absorption Spectroscopy: 6

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

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

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

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

LESSON PLAN:

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

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

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

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

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

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

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

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

Course Name	Forensic Science			
Course Code	23UCHSC42	**L**	**P**	**C**
Category	Skill Enhancement Course	1	-	1

COURSE OBJECTIVES:

This course aims at providing an overall view of the

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

UNIT - I Poisons **3**

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

UNIT - II Crime Detection **3**

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

UNIT - III Forgery and Counterfeiting **3**

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

UNIT - IV Tracks and Traces **3**

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

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

BOOKS FOR STUDY:

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

BOOKS FOR REFERENCES:

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

WEB RESOURCES:

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

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

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

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

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	S	S	S	S	S	S	S	M		
CO2	M	S	S	S	M	S	S	M		
CO3	S	S	S	M	S	S	S	M		
CO4	S	S	S	S	S	S	S	M		
CO5	S	M	S	S	S	S	S	M		

S- STRONG **M – MEDIUM** **L – LOW**

CO / PO MAPPING:

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

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

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

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

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

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

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

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