B.Sc., CHEMISTRY



Program Code: UCH

2023 - Onwards



MANNAR THIRUMALAI NAICKER COLLEGE

(AUTONOMOUS)

Re-accredited with "A⁺" Grade by NAAC

PASUMALAI, MADURAI – 625 004

Academic Council Meeting Held On 17.04.2025

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

B.SC CHEMISTRY CURRICULUM

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

Course Code	Title of the Course	Hrc	Cradits	Maxi	larks	
Course Coue	The of the Course	1115	Creans	Int	Ext	Total
	FIRST SEMESTER					
Part – I	Tamil / Alternative Course					
23UTAGT11	தமிழ் இலக்கிய வரலாறு - I	6	3	25	75	100
Part – II	English					
23UENGE11	General English - I	6	3	25	75	100
Part - III	Core Courses					
23UCHCC11	General Chemistry - I	5	5	25	75	100
23UCHCP11	Quantitative Inorganic Estimation and Inorganic Preparations - Practical	4	4	25	75	100
Part - III	Elective Courses					
23UMTEA11	Allied Mathematics - I					
/	/	5 4				100
23UMBEA12	Allied Botany- I					
Part IV	Non Major Elective					
23UCHNM11	Role of Chemistry in Daily Life	2	2	25	75	100
Part IV	Foundation Course					
23UCHFC11	Fundamentals of Chemistry	2	2	25	75	100
	Total	30	23	175	525	700
	SECOND SEMESTE	R				
Part – I	Tamil / Alternative Course					
23UTAGT21	தமிழ் இலக்கிய வரலாறு – II	6	3	25	75	100
Part – II	English					
23UENGE21	General English - II	6	3	25	75	100
Part - III	Core Courses					
23UCHCC21	General Chemistry - II	5	5	25	75	100
23UCHCP21	Qualitative Organic Analysis and Preparation of Organic Compounds - Practical	4	4	25	75	100
Part - III	Elective Courses					
23UMTEA21	Allied Mathematics - II					
/	/	5	4	25	75	100
23UMBEA22	Allied Botany- II					
Part IV	Non Major Elective	_	-			100
23UCHNM21	Dairy Chemistry	2	2	25	75	100
Part IV	Skill Enhancement course	-				
23UCHSC21	Cosmetics and Personal Care Products	2	2	25	75	100
	Total	30	23	175	525	700

Course Code	Title of the Course	Urc	Credite	Maximum Marks		
Course Coue	The of the Course	1115	Creuits	Int	Ext	Total
	THIRD SEMESTER	2				
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 SEMESTE	R				
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

Course Code	Title of the Course	Urc	Credite	Maximum Marks			
Course Coue	The of the Course	1115	Creuits	Int	Ext	Total	
	FIFTH SEMESTER	2					
Part - III	Core courses						
23UCHCC51	Organic Chemistry - I	6	4	25	75	100	
23UCHCC52	Inorganic Chemistry - I	5	4	25	75	100	
23UCHCC53	Physical Chemistry -I	5	4	25	75	100	
Part - III	Core project						
23UCHPR51	Project with viva - voce	4	3	25	75	100	
Part - III	Elective course - I						
23UCHEC51	Biochemistry	4	3	25	75	100	
Part - III	Elective course - II						
23UCHEC52	Industrial Chemistry	4	4	25	75	100	
Part - IV	Mandatory course						
23UVLEG51	Value Education	2	2	25	75	100	
23UCHIN51	Internship	-	2	25	75	100	
	Total	30	26	200	600	800	
	SIXTH SEMESTER	Ł					
Part - III	Core courses						
23UCHCC61	Organic Chemistry -II	5	3	25	75	100	
23UCHCC62	Inorganic Chemistry - II	5	3	25	75	100	
23UCHCC63	Physical Chemistry -II	6	4	25	75	100	
23UCHCP61	Physical Chemistry Practical - II	3	2	25	75	100	
Part - III	Elective course - I						
23UCHEC61	Fundamentals of Spectroscopy	4	3	25	75	100	
Part – III	Elective courses - II						
23UCHEC62	Nanoscience						
23UCHEC63	Polymer Science	4	3	25	75	100	
23UCHEC64	Pharmaceutical Chemistry						
Part - IV	Skill Course / Practical						
23UCHSP51	Professional Competency Skill -	3	2	25	75	100	
250 01101 51	Employability readiness	•	-	20	10	100	
Part - V	Extension activities						
23UNCET61,							
23UNSET61,							
23UPEE161,	N.C.C, N.S.S, Physical Education, R.R.C,						
23UKRE161,	Y.R.C, Health and Fitness Club, ECO Club &	-	1	25	75	100	
2301 KE101,	Human Rights Club						
23UFOFT61 &							
23UHRET61							
	Total	21	200	600	800		
	Grand total	180	140	1175	3525	4700	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Organic Chemistry - I								
Course Code	23UCHCC51	L +T	Р	С					
Category	Core	5+1	-	4					
COUDER OD IE/									

COURSE OBJECTIVES:

This course aims to provide an understanding of

- > stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane
- > preparation and properties of aromatic and aliphatic nitro compounds and amines
- > preparation of different dyes, food colour and additives
- > preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
- > preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.

UNIT - I Stereochemistry

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations.

Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centres, racemisation- methods of racemisation; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.

Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.

UNIT - II Chemistry of Nitrogen Compounds – I

Nitroalkanes

Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character.Nitro - aci nitro tautomerism.

Aromatic nitro compounds

Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium,

Electrophilic substitution reactions, Preparation of TNT.

Amines: Aliphatic amines

Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement.

UNIT - III Chemistry of Nitrogen Compounds – II

Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation.

Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds

Diazomethane - preparations and synthetic applications.

15+3

15 + 3

15+3

UNIT – IV Heterocyclic compounds

Nomenclature and classification. General characteristics - aromatic character and reactivity.

Five-membered heterocyclic compounds :Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.

Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction.

Thiophene synthesis - from acetylene; reactions -reduction; oxidation; electrophilic substitution reactions.

UNIT - V Six-membered heterocyclic compounds

Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses Condensed ring systems Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.

Total Lecture Hours

> M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.

- ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition, 2012.
- P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.

BOOKS FOR REFERENCES:

- S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.
- **R**. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.
- **T.W.**Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition, 2012.

WEB RESOURCES:

BOOKS FOR STUDY:

- https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/270
- https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/heterocy.htm

Nature of Course	EMPLOYABILITY			\checkmark	SK	KILL ORIE	DRIENTED		ENTREPRENEURSHIP		2	
Curriculum Relevance	LOCAL		REG	IONAL		NATIONAL			GLOBAL	~	/	
Changes Made in the Course	Percentage of Change			80		No Chang	ges Made			New Course		
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.												

15 + 3

COUR	SE OUTC	OMES:								K	LEVEL
After s	tudying	this cou	rse, the	students	s will be a	able to:	;				
CO1	assign RS ethane and	notations t l butane.	o chirals a	and EZ nota	tions to ole	efins and	explain con	formati	ions of	K	l to K4
CO2	explain pr	eparation a	nd proper	ties of arom	natic and ali	iphatic ni	tro compou	nds and	d amines	K	l to K4
CO3	explain co	lour and co	onstitution	of dyes and	d food addi	tives				K	l to K4
CO4	discuss pro thiophene	eparation a	nd propert	ties of five	membered	heterocyc	cles like pyr	role, fu	iran and	K	l to K4
CO5	discuss pro and isoqui	eparation as noline	nd propert	ies of six n	nembered h	eterocycl	les like pyri	dine, q	uinoline	K	l to K4
MAPPING WITH PROGRAM OUTCOMES:											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	РО	8 PC)9	PO10
CO 1	S	S	S	S	S	S	S	Μ	S		Μ
CO2	Μ	S	S	S	Μ	S	S	Μ	M		Μ
CO3	S	S	S	Μ	S	S	S	Μ	S		Μ
CO4	S	S	S	S	S	S	S	Μ	M	[Μ
CO5	S	M	S	S	S	S	S	Μ	M	[S
	S- STRONG M – MEDIUM L - LOW										
CO / PO MAPPING:											
C	COS PSO1 PSO2		PSO2	PSC	PSO3 I		ł	I	PSO	5	
С	01	S		S	S		S			S	
С	02	M		S	S		S			М	
С	03	S		S S			М		S		
С	04	S		S	S	S S				S	
С	05	S		Μ	S		S			S	
С	01	S		S	S		S			S	
WEIGHTED PERCENTAGE OF COURSE 3.0 CONTRIBUTI ON TO POS			3.0	3.0	D	3.0		3.0			
LESSO	N PLAN:										
UNIT			Organi	ic Chemis	stry - I			HF	RS P	ED/	AGOGY
I	 Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations. 								6 Model demonstra on, chalk talk		odel nstrati halk & alk
	Optical I enantiome	somerism : rs, distereo	Optical isomers, 1	activity, s neso struct	specific rot ures - mole	tation, as ecules wit	symmetry, h one and	8	d	M emo	odel onstrati

	two chiral centres, racemisation- methods of racemisation; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres. Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.		on, chalk & talk
	Solved Problems	3	Group Discussion
	Nitroalkanes Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character.Nitro - aci nitro tautomerism.	5	chalk & talk, ppt
п	Aromatic nitro compounds Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, Preparation of TNT.	5	chalk & talk, ppt
	Amines: Aliphatic amines Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement.	5	chalk & talk, ppt
	Solved Problems	3	Group Discussion
III	Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation.	9	chalk & talk, ppt
	Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds Diazomethane - preparations and synthetic applications.	6	chalk & talk, ppt
	Solved Problems	3	Group Discussion
	Nomenclature and classification. General characteristics - aromatic character and reactivity. Five-membered heterocyclic compounds :Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.	8	chalk & talk, ppt
IV	 Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction. Thiophene synthesis - from acetylene; reactions –reduction; oxidation; electrophilic substitution reactions 	7	chalk & talk, ppt
	Solved Problems	3	Group Discussion

	Solved Problems	3	Group Discussion
v	Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.	9	chalk & talk, ppt, seminar
	Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses Condensed ring systems	6	chalk & talk, ppt, seminar

	Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)									
Intornal	Con	K L and	Section MC(n A Ds	Section B	Section C				
Internal Cos		K Level	No. of. Questions	K - Level	Choice	Either or Choice				
CI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)				
AI	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)				
CI	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)				
AII	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)				
		No. of Questions to be asked	4		4	4				
Quest	tion	No. of Questions to be answered	4		2	2				
CIA I & II		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 %				
	K1	2	-	-	2	3.57	25				
	K2	2	10	-	12	21.43					
CIA	K3	-	10	16	26	46.43	46.43				
Ι	K4	-	-	16	16	28.57	28.57				
	Marks	4	20	32	56	100	100				
	K1	2	-	-	2	3.57	25				
	K2	2	10	-	12	21.43					
CIA	K3	_	10	16	26	46.43	46.43				
11	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.

Summati	Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)										
	COs		Section A	(MCQs)	Section B (Either / or	Section C (Either / or					
S. No		K - Level	No. of	K Laval	Choice) With	Choice) With					
			Questions	K – Level	K - LEVEL	K - LEVEL					
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)					
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)					
3	CO3	K1-K4	2 K1&K2		2 (K2,K2)	2 (K3,K3)					
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)					
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)					
No. of Q	uestions to	be Asked	10		10	10					
No. of Que	estions to b	be answered	10		5	5					
Marks for each question		1		5	8						
Total Marks for each section		ch 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	20				
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.

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

Summative Examinations - Question Paper – Format

Answer ALL the questions				PART – B	$(5 \times 5 = 25 \text{ Marks})$				
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	$(5 \times 8 = 40 \text{ Marks})$				
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						

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Inorganic Chemistry - I						
Course Code	23UCHCC52	L	Р	С			
Category	Core	4+1	-	4			
COURSE OBJE	CTIVES.						

The course aims to provide knowledge on

- > nomenclature, isomerism and theory of coordination compounds, and chelate complexes
- > crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
- > preparation and properties of metal carbonyls
- > Lanthanoids and actinoids
- > preparation and properties of inorganic polymers

UNIT - I Co-ordination Chemistry - I

IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds (octahedral and square planar complexes alone). Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory – geometry of co-ordination compounds with co-ordination number 4 & 6.

Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis– application of DMG in gravimetric analysis –estimation of hardness of water using EDTA.

Role of metal chelates in living systems – haemoglobin and chlorophyll (structure and functions only)

UNIT - II Co-ordination Chemistry - II

Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, interpretation of magnetic properties, and electronic spectra of $[Ti(H_2O)_6]^{3+}$ - Jahn – Teller effect in complexes formed by Cu(II) ions. Factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea).

UNIT - III Organometallic compounds

Metal Carbonyls

Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Mn, Ru and Os. EAN rule as applied to metal carbonyls.

Ferrocene-Methods of preparation, physical and chemical properties .

Page 856

12+3

12+3

12+3

UNIT - IV Inner transition elements (Lanthanoids and Actinoids)

General characteristics of f-block elements - Comparative account of lanthanoids and actinoids -Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids, Lanthanoids contraction- Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate,

UNIT - V Inorganic polymers

General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and properties of silicones (polydimethylsiloxane and polymethylhydrosiloxane) phosphorous based polymer (polyphosphazines and polyphophonitrilic chloride), sulphur based polymer polymeric sulphur nitride, boron based polymers (borazine polymers) – industrial applications of inorganic polymers.

BOOKS FOR STUDY:

- Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31thEdition, Milestone Publishers & Distributors, Delhi.
- Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi
- > Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London.

BOOKS FOR REFERENCES:

- Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed., S.Chand and Company, New Delhi.
- Gopalan R, (2009) Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited, Hyderabad
- Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

WEB RESOURCES:

- https://onlinecourses.nptel.ac.in/noc19_cy19/preview
- https://archive.nptel.ac.in/courses/104/101/104101079/

Nature of Course	EMPLOYABILITY			\checkmark	SKILL ORIENTED			ENTREPRENEURSHIP		D
Curriculum Relevance	LOCAL REG		REGI	ONAL		NATIONAL			GLOBAL	\checkmark
Changes Made in the Course	Percentage of Change			60	No Chan	No Changes Made			New Course	
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.										

12+3

12 + 3

75

Total Lecture Hours

COURS	SE OUTC	OMES:							K	LEVEL
After s	After studying this course, the students will be able to:									
CO1	explain iso	omerism, W	erner's Tl	neory and s	stability of	chelate con	mplexes		K	1 to K4
CO2	discuss crystal field theory, magnetic properties and spectral properties of complexes. K1 to K4									1 to K4
CO3	explain preparation and properties of metal carbonyls K									1 to K4
CO4	give a comparative account of the characteristics of lanthanoids and actinoids K1 to K4									1 to K4
CO5	5 Explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous								K	1 to K4
MAPPI	NG WITH	I PROGR	AM OUT	COMES:						1
CO/PC	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	Μ	S	M
CO2	Μ	S	S	S	Μ	S	S	Μ	Μ	M
CO3	S	S	S	Μ	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	Μ	M
CO 5	S	M	S	S	S	S	S	Μ	Μ	S
	S- STROI	NG			M – MED	IUM			L - LO	W
CO / P	O MAPPI	ING:								
C	os	PSO1]	PSO2	PSO3		PSO4		PSO5	
C	01	3		3	3		3		3	
C	02	3		3	3		3		3	
C	03	3		3	3		3		3	
C	04	3		3	3		3		3	
C	05	3 3		3		3		3		
Weight	age	e 15 15		15	5	15		15		
Weight percent Course Contrib to Pos	ed age of oution	3.0		3.0	3.0	D	3.0		3.0	

LESSON PLAN:									
UNIT	Inorganic Chemistry - I	HRS	PEDAGOGY						
	IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds (octahedral and square planar complexes alone). Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory – geometry of co-ordination compounds with co-ordination number 4 & 6.	7	Model demonstrati on,chalk & talk, ppt						
I	Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis – application of DMG in gravimetric analysis –estimation of hardness of water using EDTA. Role of metal chelates in living systems – haemoglobin and chlorophyll (structure and functions only)	8	Model demonstrati on,chalk & talk, ppt						
	Solved Problems	3	Group discussion						
II	Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting	8	Model demonstrati on,chalk & talk, ppt						
	interpretation of magnetic properties, and electronic spectra of $[Ti(H_2O)_6]^{3+}$ - Jahn – Teller effect in complexes formed by Cu(II) ions . factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea).	7	chalk & talk, ppt						
	Solved Problems	3	Group discussion						
	Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls	5	chalk & talk, ppt						
III	bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Mn, Ru and Os. EAN rule as applied to metal carbonyls. Ferrocene-Methods of preparation, physical and chemical properties	10	chalk & talk, ppt						
	Solved Problems	3	Group discussion						
	General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids,	8	chalk & talk, ppt						
IV	Lanthanoids contraction- Chemistry of thorium and UraniumOccurrence, Ores, Extraction, properties and uses - Preparation,Properties and uses of ceric ammonium sulphate	7	chalk & talk, ppt						
	Solved Problems	3	Group discussion						
	General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and properties of silicones (polydimethylsiloxane and polymethylhydrosiloxane)	8	chalk & talk, ppt, seminar						
v	phosphorous based polymer (polyphosphazines and polyphophonitrilic chloride), sulphur based polymer - polymeric sulphur nitride, boron based polymers (borazine polymers) – industrial applications of inorganic polymers.	7	chalk & talk, ppt, seminar						
	Solved Problems	3	Group discussion						

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print										
	Articulation Mapping – K Levels with Course Outcomes (COs)									
			Section	n A	Section B					
Internal	Cos	K Level	MCQ	2s	Either or	Section C				
Internat			No. of. Questions	K - Level	Choice	Either or Choice				
CI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)				
AI	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)				
CI	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)				
AII	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)				
		No. of Questions to be asked	4		4	4				
Quest	tion	No. of Questions to be answered	4		2	2				
CIA I & II		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 %			
	K1	2	-	-	2	3.57	25			
	K2	2	10	-	12	21.43				
CIA	K3	-	10	16	26	46.43	46.43			
I	K4	-	-	16	16	28.57	28.57			
-	Marks	4	20	32	56	100	100			
	K1	2	-	-	2	3.57	25			
	K2	2	10	-	12	21.43				
CIA	K3	_	10	16	26	46.43	46.43			
II	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.

Summati	Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)									
			Section A	(MCQs)	Section B (Either / or	Section C (Either / or				
S. No	COs	K - Level	No. of	K – Level	Choice) With	Choice) With				
			Questions		K - LEVEL	K - LEVEL				
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)				
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)				
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)				
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)				
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)				
No. of Q	uestions to	be Asked	10		10	10				
No. of Que	estions to l	be answered	10		5	5				
Marks for each question			1		5	8				
Total Marks for each section			10		25	40				
	(Figu	ires in parent	thesis denotes.	questions show	uld be asked with the give	en 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	20			
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.									

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

Summative Examinations - Question Paper – Format

Answer A	LL the que	stions	PAR	T – 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					

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Physical Chemistry - I							
Course Code	23UCHCC53	L+T	Р	С				
Category	Core	4+1	-	4				
COURSE OF IECONIES.								

COURSE OBJECTIVES:

The course aims at providing an overall view of

- > Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties
- \succ chemical kinetics and different types of chemical reactions
- adsorption, homogeneous and heterogeneous catalysis
- > colloids and macromolecules
- > photochemistry, fluorescence and phosphorescence

UNIT - I **Thermodynamics - III**

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, Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.

Partial molar properties - chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs- Duhem-Margules equation.

UNIT - II **Chemical Kinetics**

Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, and first order,

Methods of determination of order of Volumetry and polarimetry.

Effect of temperature on reaction rate - temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates - Collision theory - derivation of rate constant of bimolecular gaseous reaction. Lindemann's theory of unimolecular reaction(Elementary idea). Theory of absolute reaction rates -Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.

UNIT - III **Adsorption and Catalysis**

Adsorption - Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory (No derivation),

Catalysis – general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst - theories of homogenous and heterogeneous catalysis - Kinetics of Acid - base and enzyme catalysis -Michaelis- Menten equation - Lineweaver- Burk plot - inhibition - reversible competitive, noncompetitive and uncompetitive (no derivation of rate equations)

12 + 3

12 + 3

12 + 3

Academic Council Meeting Held On 17.04.2025

ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co.
Pater Atking, and Julia de Paula, James Kapler, Physical Chemistry, Oxford University press.

Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.

BOOKS FOR REFERENCES:

eighth edition, 2021.

- > J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013.
- > Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003
- K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009.

WEB RESOURCES:

BOOKS FOR STUDY:

- https://archive.nptel.ac.in/courses/104/106/104106089/
- https://archive.nptel.ac.in/courses/103/106/105106204/

Nature of Course	EMPLOYABILITY			\checkmark	SKILL ORIENTED			ENTREPRENEURSHIP		2
Curriculum Relevance	LOCAL	LOCAL REGIONAL				NATIONAL			GLOBAL	\checkmark
Changes Made in the Course	Percentag	Percentage of Change		40	No Char	nges Made			New Course	

UNIT – IV Colloids and Surface Chemistry

Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols),

Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols- Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis. Electrophoresis. Applications of colloids

Macromolecules: Molecular weight of Macromolecules-Number average molecular weight- average molecular weight, Determination of Molecular weight of macromolecules (Gel Permeation Chromatography method).

UNIT - V Photochemistry

Laws of photochemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H_2 - Cl_2 , H_2 - Br_2 and H_2 - I_2 reactions, comparison between thermal and photochemical reactions.

Fluorescence – applications including fluorimetry – sensitised fluorescence, phosphorescence – applications - chemiluminescence and photosensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision

> B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty

Total Lecture Hours

75

Page 865

12 + 3

COURS	SE OUTC	OMES:							K	LEVEL
After studying this course, the students will be able to:										
CO1	explain Gi Ellingham	bbs and He	elmholtz f	ree energy	functions, j	partial mol	ar quantitie	es and	ŀ	K1 to K4
CO2	apply the oreaction, of free energy	concepts of lemonstrate y and entro	chemical the effec py of acti	kinetics to t of tempera vation.	predict the ature on rea	e rate of the action rate	e reaction a , and the sig	nd order ognificance	of the sof	K1 to K4
CO3	compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.								K1 to K4	
CO4	demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules. K1 to K4									
C05	utilize the chemilum	concepts o inescence a	f photoche and color p	emistry in f perception o	luorescenc of vision.	e, phospho	prescence,		F	K1 to K4
MAPPI	NG WITH	I PROGR	AM OU1	COMES:						
CO/PC	D PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	S	S	S	M	S	Μ
CO2	M	S	S	S	M	S	S	Μ	Μ	Μ
CO3	S	S	S	M	S	S	S	M	S	Μ
CO4	S	S	S	S	S	S	S	Μ	M	Μ
CO 5	S	М	S	S	S	S	S	Μ	M	S
1	S- STROI	NG			M – MEI	DIUM			L - LO	W
CO / P	O MAPP	ING:								
С	os	PSO1	-	PSO2	PS	03	PSO4		PSO5	
С	01	3		3	3	3			3	
С	02	3		3	3	}	3		3	
C	03	3		3	3	}	3		3	
С	04	3		3	3	8	3		3	
C	05	5 3		3	3	6	3		3	
Weig	htage	tage 15 15 15 15 1						1	5	
Weig percer Co Contr to	ghted ntage of urse ibution Pos	3.0		3.0	3.	0	3.0		3.	0

LESSC	ON PLAN:		
UNIT	Physical Chemistry - I	HRS	PEDAGOGY
I	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, Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.	8	chalk & talk, ppt
-	Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs- Duhem-Margules equation.	7	chalk & talk, ppt
	Solved Problems	3	Group discussion
II	Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, and first order, Methods of determination of order of Volumetry and polarimetry.	7	chalk & talk, ppt
	Effect of temperature on reaction rate – temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction. Lindemann's theory of unimolecular reaction(Elementary idea). Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.	8	chalk & talk, ppt
	Solved Problems	3	Group discussion
	Adsorption – Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory (No derivation),	7	chalk & talk, ppt
ш	Catalysis – general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis –Michaelis- Menten equation – Lineweaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations)	8	chalk & talk, ppt
	Solved Problems	3	Group discussion
IV	Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols), Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols- Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis. Electrophoresis. Applications of colloids.	8	chalk & talk, ppt
	Macromolecules: Molecular weight of Macromolecules-Number average molecular weight- average molecular weight, Determination of Molecular weight of macromolecules (Gel Permeation Chromatography method).	7	chalk & talk, ppt

	Solved Problems	3	Group discussion
	Laws of photochemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H2-Cl2, H2-Br2 and H2-I2 reactions, comparison between thermal and photochemical reactions.	8	chalk & talk, ppt, seminar
v	Fluorescence – applications including fluorimetry – sensitised fluorescence, phosphorescence – applications - chemiluminescence and photosensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision	7	chalk & talk, ppt, seminar
	Solved Problems	3	Group discussion

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print										
	Articulation Mapping – K Levels with Course Outcomes (COs)									
			MCC	ll A De	Section B	Section C				
Internal	Cos	K Level	No. of.	ZS K-	Either or	Either or Choice				
			Questions	Level	Choice					
CI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)				
AI	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)				
CI	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)				
AII	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)				
		No. of Questions to be asked	4		4	4				
Quest	tion	No. of Questions to be answered	4		2	2				
CIA I & II		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 %			
	K1	2	-	-	2	3.57	25			
	K2	2	10	-	12	21.43				
CIA	K3	-	10	16	26	46.43	46.43			
Ι	K4	-	-	16	16	28.57	28.57			
	Marks	4	20	32	56	100	100			
	K1	2	-	-	2	3.57	25			
	K2	2	10	-	12	21.43				
CIA	K3	-	10	16	26	46.43	46.43			
11	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.

Summati	Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)								
			Section A	(MCQs)	Section B (Either / or	Section C (Either / or			
S. No	COs	K - Level	No. of	K – Level	Choice) With	Choice) With			
			Questions	K Level	K - LEVEL	K - LEVEL			
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)			
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)			
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)			
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)			
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)			
No. of Q	uestions to	be Asked	10		10	10			
No. of Que	estions to b	be answered	10		5	5			
Marks for each question			1		5	8			
Total Marks for each section			10		25	40			
	(Fig)	ires in naren	thesis denotes.	questions show	ıld he asked with the give	en 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	20			
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	СО	K-level		
Answer A	LL the quest	tions		PART – A	(10 x 1 = 10 Marks)
	Unit - I	CO1	K1		
1.				a)	b)
				c)	d)
	Unit - I	CO1	K2		
2.				a)	b)
				c)	d)
	Unit - II	CO2	K1		
3.				a)	b)
				c)	d)
	Unit - II	CO2	K2		
4.				a)	b)
				c)	d)
	Unit - III	CO3	K1		
5.				a)	b)
				c)	d)
	Unit - III	CO3	K2		
6.				a)	b)
				c)	d)
	Unit - IV	CO4	K1		
7.				a)	b)
				c)	d)
	Unit - IV	CO4	K2		
8.				a)	b)
				c)	d)
	Unit - V	CO5	K1		
9.				a)	b)
				c)	d)
	Unit - V	CO5	K2		
10.				a)	b)
				c)	d)

Answer A	LL the quest	ions	J	PART – B	$(5 \times 5 = 25 \text{ Marks})$						
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 ALI	the question	ns		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								

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Project with Viva - Voce								
Course Code	23UCHPR51	L	Р	С					
Category	Core	4	-	3					
COURSE OBJE	CTIVES:	i							
 To identify, To collect, a To choose, To work with To present the 	describe the problem and scope of project nalyse and present data into significant form using appropriate tools plan and implement a proper approach in problem solving h team and ethically he findings in both oral and written form								
Course Deserir	tion								
Guidelines For Int 1. There will 2. A Group of 3. The studen 4. The Marks Viva - Vo	ternship: be one Faculty guide. f two students join to do a project ts should submit a Project Report (Maximum 30 Pages). for Project Report will be awarded only on the basis of the Projece.	ect Re	eport wit	th					
The Project is cond	ucted by the following Course Pattern.								
Internal									
Project work & Sul	omission 25								
External									
Project Report Viva Voce 75									
Total	- 100								
	Total Practical Ho	ours		60					

Nature of Course	EMPLOYABILITY				SKILL OR	IENTED	\checkmark	ENTREPRENEURSHIP		P
Curriculum Relevance	LOCAL		REGI	ONAL	 ✓ 	NATION	AL	GLOBAL		
Changes Made in the Course	Percentag	e of Ch	ange		No Char	nges Made	V	·	New Course	
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.										

COURS	E OUTCO	MES:							K	- Level
CO1	Apply the	skill of pre	sentation	and commu	unication te	chniques			K	1 to K4
CO2	work as ar	n individual	l or in a te	am in deve	lopment of	projects.			K	1 to K4
CO3	Analyze th	ne available	e resources	and to sel	ect most ap	propriate o	one		K	1 to K4
CO4	Make use	of the fund	amentals o	of Chemist	try to ident	ify the rela	ated literati	ure	K	1 to K4
CO5	Explain th	e real life p	problems b	y using Ch	nemistry an	d its Appli	cation.		K	1 to K4
MAPPING WITH PROGRAM OUTCOMES:										
CO/PC	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	Μ
CO2	М	S	S	S	M	S	S	M	Μ	Μ
CO3	S	S	S	М	S	S	S	M	S	Μ
CO4	S	S	S	S	S	S	S	Μ	Μ	Μ
CO5	S	М	S	S	S	S	S	Μ	Μ	S
5	S- STROI	1G			M – MED	IUM			L - LO	W
CO / P	O MAPPI	ING								
C	os	PSO1		PSO2	PSO3	03	PSO4		PSO5	
C	01	3		3	3		3		3	
C	02	3		3	3		3		3	
C	03	3		3	3	,	3		3	
C	04	3		3	3	,	3		3	
C	05	3		3	3		3		3	
Weig	Weightage 15			15	1	5	15		15	5
Weig percen Cou Contri to	chted stage of strse stution POs	3.0		3.0	3.	0	3.0		3.0	

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Biochemistry			
Course Code	23UCHEC51	L + T	Р	С
Category	Elective	4	-	3

COURSE OBJECTIVES:

The course aims at providing knowledge on

- > relationship between biochemistry and medicine, composition of blood
- > structure and properties of amino acids, peptides, enzyme, vitamins and proteins
- biological functions of proteins, enzymes, vitamins and hormones
- ➢ biochemistry of nucleic acids and lipids
- > metabolism of lipids

UNIT - I Logic of Living Organisms

Relationship of Biochemistry and Medicine Blood - Composition of Blood, Blood Coagulation – Mechanism. Hemophilia and Sickle Cell Anaemia Maintenance of pH of Blood – Bicarbonate Buffer, Acidosis, Alkalosis.

UNIT - II Peptides and Proteins

Amino acids – nomenclature, classification – essential and Non- essential; Synthesis - Gabriel Phthalimide, Strecker; properties – zwitter ion and isoelectric point.

Peptides – peptide bond – nomenclature – synthesis of simple peptides – solution and solid phase. Determination of structure of peptides, N- terminal analysis – Sanger's & Edmann method; C terminal analysis - Enzymic method.

Proteins – classification based on composition, functions and structure; properties and reactions – colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins – primary, secondary, tertiary and quaternary.

UNIT - III Enzymes and Vitamins

Nomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model.

Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, FMN, FAD, CoA, folic acid, biotin, cyanocobalamin.

UNIT - IV Amino acids and Hormones

Amino acids - Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions; RNA –types– structure - functions; biosynthesis of proteins

Hormones -Adrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).

12

12

111. 12

UNI	r - V Lipids	12
Lipid	s -Occurrence, biological significance of fats, classification of lipids.	
Simp	le lipids – Oils and fats, chemical composition, properties, reactions	
-hyc	lrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils	and fats –
sapon	ification number, iodine number, acid value, R.M. value. Distinction between animal and	l vegetable
fats.		0
Com	bound lipids – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance.	
Chole	esterol – occurrence, structure, test	
	Total Lecture Hours	75
BOO	KS FOR STUDY:	
	Bahl, B. S.; Bhal, A. Advanced Organic Chemistry, 3rd ed.; S. Chand: New Delhi, 2003.	
	Jain, M.K.: Sharma, S.C. Modern Organic Chemistry, Vishal Publications: New Delhi, 20	17.
	Shanmugam A Fundamentals of Biochemistry for Medical Students 6th ed : Published h	by the
	author, 1999.	y the
BOO	KS FOR REFERENCES:	
>	Conn, E. E.; Stumpf, P. K. Outline of Biochemistry, 5th ed.; Wiley Eastern: New Delhi, 2	002.
►	West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. Text Book of Biochemistry, 4	th ed.;
	Macmillan: New York, 1970.	,
►	Rastogi, S. C. Biochemistry, 2nd ed.; Tata McGraw-Hill: New Delhi, 2003.	
WEB	RESOURCES:	
*	http://library.med.utah.edu/NetBiochem/nucacids.html	
*	https://swavam.gov.in/courses/4384-biochemistry	

https://onlinecourses.nptel.ac.in/noc19_cy07/preview

Nature of Course	EMPLOYABILITY				SKILL OR		ENTREPRENEURSHIP			\checkmark	
Curriculum Relevance	LOCAL		REGI	ONAL		NATION	AL	\checkmark	GLOBAL		
Changes Made in the Course	Percentage of Change				No Chan	iges Made			New Course		✓
* Treat 20% as each unit (20*5–100%) and calculate the percentage of change for the course											

a calculate th e or cn

COUR	SE OUTC	OMES:							1	K LEVEL	
After s	studying	this cou	rse, t	he students	s will be a	able to:					
CO1	explain m	olecular log	gic of li	iving organism	ns, composi	tion of bl	ood and blo	od coag	ulation	K1 to K4	
CO2	explain sy and protei	nthesis and ns	l prope	rties of amino	acids, deter	rmination	of structure	of pept	ides	K1 to K4	
CO3	explain fa	ctors influe	encing e	enzyme activit	y and vitan	nins as co	enzymes]	K1 to K4	
CO4	explain Rl	NA and DN	JA stru	cture and func	tions]	K1 to K4	
CO5	explain bi	ological sig	gnificar	nce of simple a	and compou	Ind lipids]	K1 to K4	
MAPPING WITH PROGRAM OUTCOMES:											
CO/P	0 PO1	PO2	PO	03 PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	S	S	S	S	S	S	S	М	S	М	
CO2	М	S	S	S	М	S	S	М	м	М	
CO3	S	S	S	М	S	S	S	М	S	М	
CO4	S	S	S	S	S	S	S	Μ	м	М	
CO5	S	М	S	S	S	S	S	М	м	S	
	S- STROI	NG			L - L(W					
CO / PO MAPPING:											
С	COS PSO1			PSO2	PSC)3	PSO4	•	PS	05	
C	:01	3		3	3		3		(3	
C	202	3		3	3	3			(3	
C	203	3		3	3		3			3	
C	:04	3		3	3	3			3		
C	:05	3		3	3		3		3		
Weig	ghtage	15		15	15	5	15		15		
Wei percer Co Contr to	ghted ntage of urse ibution POs	3.0		3.0	3.0	D	3.0		3.0		
LESSC	ON PLAN:										
UNIT				Biochemist	ry			HRS	S PE	DAGOGY	
Ŧ	Relationsh Blood, Blo	nip of Biocl ood Coagul	hemistı lation –	ry and Medicir - Mechanism.	ne Blood - (Composit	ion of	6	6 chalk & talk, ppt		
•	Mechanisn Blood – Bi	n. Hemoph	ilia anc Buffer,	l Sickle Cell A Acidosis, Alk	Anaemia Ma alosis.	aintenanc	e of pH of	6	6 chalk & talk, ppt		
п	Amino ac essential; S ion and iso	ids – noi Synthesis - pelectric po	nencla Gabrie int.	ture, classific el Phthalimide.	ation – e , Strecker;	ssential a properties	and Non- s – zwitter	6	Ani so	mations using ftware,	

	Peptides – peptide bond – nomenclature – synthesis of simple peptides – solution and solid phase. Determination of structure of peptides, N-terminal analysis – Sanger's & Edmann method; C terminal analysis - Enzymic method.		chalk & talk, ppt
	Proteins – classification based on composition, functions and structure; properties and reactions – colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins – primary, secondary, tertiary and quaternary.	6	Animations using software, chalk & talk, ppt
III	Nomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model.	6	Animations using software, chalk & talk, ppt
	Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, FMN, FAD, CoA, folic acid, biotin, cyanocobalamin.	6	Animations using software, chalk & talk, ppt
	Amino acids - Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA-structure & functions; RNA –types– structure - functions; biosynthesis of proteins	6	Animations using software, chalk & talk, ppt
10	Hormones - Adrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).	6	Animations using software, chalk & talk, ppt
v	 Lipids -Occurrence, biological significance of fats, classification of lipids. Simple lipids – Oils and fats, chemical composition, properties, reactions hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats – saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats. 	8	Animations using software, chalk & talk, ppt, seminar
	Compound lipids – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance. Cholesterol – occurrence, structure, test	4	Animations using software, chalk & talk, ppt, seminar

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

		Dis	tribution of	Marks with	K Level	CIA I & CIA I	I
	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 %
	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
CIA	K3	-	10	16	26	46.43	46.43
Ι	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
	K1	2	-	-	2	3.57	25
~~ (K2	2	10	-	12	21.43	
CIA	K3	_	10	16	26	46.43	46.43
11	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)										
			Section A	(MCQs)	Section B (Either / or	Section C (Either / or				
S. No	COs	K - Level	No. of	K Lovol	Choice) With	Choice) With				
			Questions	K – Level	K - LEVEL	K - LEVEL				
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)				
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)				
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)				
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)				
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)				
No. of Q	uestions to	be Asked	10		10	10				
No. of Que	estions to l	be answered	10	5		5				
Marks for each question		1	5		8					
Total Marks for each section		ch 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	20				
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.

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

Summative Examinations - Question Paper – Format

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		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Industrial Chemistry									
Course Code	Code23UCHEC52LPCElementiiii									
Category Elective 4 -										
COURSE OBJEC	CTIVES:	I								
This course is de	esigned to provide knowledge on									
classification	ns and characteristics of fuels									
> preparation of	of cosmetics									
manufacture	of sugar, paper, cement and leather and food processing									
> applications	of abrasives, lubricants and other industrial products									
> intellectual p	property rights									
UNIT - I Su	rvey of Indian Industries and mineral resources in I	ndia		12						
 characteristics; C unleaded petrol-oct Gaseous fuel: adva preparations - use composition, advan 	 analysis and ultimate analysis; calorific value-determination, carbonisation of coal. Liquid fuels: Petroleum characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number. Bio diesel (elementary idea) Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas - preparations - uses. Natural gas: LPG-composition, advantages, application; gobar gas- production, composition, advantages, application; gobar gas- production, 									
UNIT - II Co	osmetics, Soaps and Detergents			12						
Skin care: powder	s, ingredients; creams and lotion-cleansing, moisturising, all-purp	ose s	having	cream,						
sunscreen;										
Dental care: tooth p	bastes – ingredients									
Hair care: shampoo	s-types, ingredients; conditioners-types, ingredients.									
Soaps-properties, n ingredients.	nanufacture of soap-batch process; types-transparent soap, toilet soa	ip and	l liquid	soap –						
Detergents-definition	Detergents-definition, properties-cleansing action; Anionic, cationic and non-ionic (general idea only);									
Biodegradability of soaps and detergents.										
UNIT - III Su	igar Industry & Food Preservation and processing			12						
Sugar industry										
Manufacture from s	sugar cane; recovery of sugar from molasses; testing and estimation	of sug	gar.							
Food Preservation	and processing									
Food spoilage – cau	uses; Food preservation - methods – high temperature, low temperatu	ıre, dı	rying,							
radiation; Food additives – preservatives (Sodium benzoate, Potassium sorbate), Bio preservatives										

(Bacteriocins, lactic acid), flavours (vanilla, Limonene), colours (Sunset yellow, β - carotene), sweetening agents (saccharine, aspartine); hazards of using food additives; Food standards – Agmark and Codex alimentarius.

UNIT – IV Leather Industry & Paper Industry

Leather Industry

Structure and composition of skin, hide; Manufacture of leather – pre- tanning process – curing, liming, beating, pickling; methods of tanning- vegetable, chrome – one bath, two bath process; finishing.

Paper Industry

Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paperbeating, refining, filling, sizing, colouring, calendaring; cardboard.

UNIT -	v	Cement Industry	& Intellectual Property Rights	12
UNIT -	V	coment maustry	a inconcectual i toperty Rights	14

Cement Industry

Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete.

Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks-Certification marks, logos, brand names, signatures, symbols and service marks

BOOKS FOR STUDY:

- Sharma, B.K. Industrial Chemistry, 9th ed.; Goel Publishing House: Meerut, 1998.
- Wilkinson, J.B.E. Moore, R.J. Harry's Cosmeticology, 7th ed.; Chemical Publishers : New York, 1982.
- > Jayashree Ghosh, Applied Chemsitry, S. Chand : New Delhi, 2006.

BOOKS FOR REFERENCES:

- Jain, P.C.; Jain, M. Engineering Chemistry, 16th ed.; Dhanapet Rai: Delhi, 1992
- George Howard, Principles and Practice of Perfumes and Cosmetics, Stanley Therones, Cheltenham: UK, 1987.
- ShankuntalaManay, N.; Shadaksharaswamy, M. Food Facts and Principles, 3rd ed.; New Age Publication, 2008.

> Neeraj Pandey, KhushdeepDharni, Intellectual Property Rights, PHI Learning, 2014.

WEB RESOURCES:

- http://www.sciencecases.org/irradiation/irradiation_notes.asp
- http://discovery.kcpc.usyd.edu.au//9.5.5/
- https://www.wipo.int/about-ip/en/

Nature of Course	EMPLC	YABII	LITY	\checkmark	SKILL OR	SKILL ORIENTED			ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGI	EGIONAL NATIONAL		\checkmark	GLOBAL				
Changes Made in the Course	Percentage of Change				No Char	iges Made			New Course	✓	
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course											

COUR	SE OUTC	OMES:							K	LEVEL	
After s	studying	this cou	rse, the	students	s will be	able to:					
CO 1	summarize the properties of fuels which include petroleum, water gas, natural gas and propellants										
CO2	evaluate cosmetic products, soaps, detergents. K1 to K4										
CO3	explain ma	anufacture	of sugar, f	ood spoilag	ges and foo	d additives	8		K	1 to K4	
CO4	explain pr	operties of	abrasives,	manufactu	re of leathe	er and pape	er		K	1 to K4	
CO5	explain pr rights	operties an	d manufac	ture of lubr	ricants and	cement, ar	nd intellect	tual proper	ty K	1 to K4	
MAPPI	NG WITH	I PROGR	AM OUT	COMES:					1		
CO/PO	D PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	S	S	S	S	S	S	S	Μ	S	Μ	
CO2	M	S	S	S	Μ	S	S	Μ	M	M	
CO3	S	S	S	M	S	S	S	Μ	S	M	
CO4	S	S	S	S	S	S	S	Μ	Μ	M	
C05	S	M	S	S	S	S	S	Μ	M	S	
	S- STROI	NG			M – MED	IUM			L - LO	W	
CO / F	PO MAPPI	ING:									
C	OS	PSO1		PSO2	PSC	03	PSO ₂	ŀ	PSC)5	
C	01	3		3	3		3		3		
С	02	3		3	3		3		3		
C	03	3		3	3		3		3		
С	04	3		3	3		3		3		
C	05	5 3		3	3		3		3		
Weig	ightage 15 15 15 15 15						5				
Weig percen Co Contr to	ghted ntage of urse ibution POs	3.0		3.0	3.0	D	3.0		3.0		

LESSC	ON PLAN:		
UNIT	Industrial Chemistry	HRS	PEDAGOGY
I	Fuels: Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal- proximate analysis and ultimate analysis; calorific value-determination, carbonisation of coal. Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number. Bio diesel (elementary idea)	6	chalk & talk, ppt
	Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas - preparations - uses. Natural gas: LPG-composition, advantages, application; gobar gas- production, composition, advantages, application. Propellants – rocket fuels (composition alone)	6	chalk & talk, ppt
	Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all-purpose shaving cream, sunscreen; Dental care: tooth pastes – ingredients Hair care: shampoos-types, ingredients; conditioners-types, ingredients.	6	chalk & talk, ppt, analyzing commercial ly available products
II	Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap and liquid soap – ingredients. Detergents-definition, properties-cleansing action; Anionic, cationic and non-ionic (general idea only); Biodegradability of soaps and detergents.	6	chalk & talk, ppt, analyzing commercial ly available products
	Sugar industry Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar.	2	Chalk & talk
III	Food Preservation and processing Food spoilage – causes; Food preservation - methods – high temperature, low temperature, drying, radiation; Food additives – preservatives (Sodium benzoate, Potassium sorbate), Bio preservatives (Bacteriocins, lactic acid), flavours (vanilla, Limonene), colours (Sunset yellow, β - carotene), sweetening agents (saccharine, aspartine); hazards of using food additives; Food standards – Agmark and Codex alimentarius.	8	chalk & talk, ppt, analyzing commercial ly available products
π7	Leather Industry Structure and composition of skin, hide; Manufacture of leather – pre- tanning process – curing, liming, beating, pickling; methods of tanning- vegetable, chrome – one bath, two bath process; finishing.	6	chalk & talk, ppt,
14	Paper Industry Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.	6	chalk & talk, ppt,
V	Cement Industry		chalk &

Cement – types, raw materials; manufacture-wet process, constituent of	talk, ppt,
cement, setting of cement; properties of cement-quality, setting time,	Industrial
soundness, strength; mortar, concrete, RCC; curing and decay of	Visit,
concrete.	Assignment
Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks	Guest Lecture

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

		Dist	ribution of N	Aarks with l	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 %
	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
CIAI	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
	K1	2	-	-	2	3.57	25
CIA II	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)									
			Section A	(MCQs)	Section B (Either / or	Section C (Either / or			
S. No	COs	K - Level	No. of Questions	K – Level	Choice) With K - LEVEL	Choice) With K - LEVEL			
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)			
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)			
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)			
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)			
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)			
No. of Qu	uestions to	be Asked	10		10	10			
No. of Que	estions to b	be answered	10		5	5			
Marks for each question			1		5	8			
Total Marks for each section			10	25		40			
	(Figu	ires in parent	thesis denotes,	questions show	uld be asked with the give	en 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	20				
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 A	LL the quest	tions	Р	ART – A	(10 x 1 = 10 Marks)
	Unit - I	CO1	K1		
1.				a)	b)
				c)	d)
	Unit - I	CO1	K2		
2.				a)	b)
				c)	d)
	Unit - II	CO2	K1		
3.				a)	b)
				c)	d)
	Unit - II	CO2	K2		
4.				a)	b)
				c)	d)
	Unit - III	CO3	K1		
5.				a)	b)
				c)	d)
	Unit - III	CO3	K2		
6.				a)	b)
				c)	d)
	Unit - IV	CO4	K1		
7.				a)	b)
				c)	d)
	Unit - IV	CO4	K2		
8.				a)	b)
				c)	d)
	Unit - V	CO5	K1		
9.				a)	b)
				c)	d)
	Unit - V	CO5	K2		
10.				a)	b)
				c)	d)

Answer A	LL the quest	tions	F	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						

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Internship			
Course Code	23UCHIN51	L	Р	С
Category	Summer Internship	-	-	2
COUDER OD IE				

COURSE OBJECTIVES:

Students should undergo internship in core companies like (but not limited to) pharmaceuticals, fertilizer manufacturing, polymer synthesis, paper industry, sugar factory, cement factory for 30 hours during IV semester vacation.

Guidelines For Internship:

1. The Project is conducted by the following Course Pattern. The internship period should be minimum 30 hours.

2. Each group should produce permission letter as well as the attendance certificate.

3. There will be one Faculty guide.

4. The students should submit an Internship Training Report (Maximum 30 Pages).

5. The Marks for Internship Training will be awarded only on the basis of the Internship Training Report.

6. Prior permission may be obtained from the organization in advance by the students concerned and information shall be passed onto the colleges thus enabling the training supervision by the concerned faculties authorized by the college.

7. Daily postal or electronic reporting should be obtained to ensure coherent and comprehensive training during the training period.

8. A final report [Institutional Training Record – ITR] containing the introduction of the industry, the profile of the company and a valid conclusion indicating the benefits of the training shall be given not exceeding 30 [A4] pages [in a spiral- bound form/pre-printed record designed for this purpose]

Internal

Exter	Presentation Submission nal	}	25
	Project Report Viva Voce	<pre>}</pre>	75
Total	-	100	

Nature of Course	EMPLC	YABII	LITY		SKILL OR	\checkmark	ENTREPRENEURSHIP		,	
Curriculum Relevance	LOCAL		REGI	ONAL	· •	NATION	AL			
Changes Made in the Course	Percentag	e of Ch	ange		No Char	nges Made			✓	
		• •/								

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

COUR	SE OUTC	OMES:							K	LEVEL			
After s	After studying this course, the students will be able to:												
CO 1	Explain the environment and expectations of performance on the part of private/public companies or government entities												
CO2	Able to develop work habits and attitudes necessary for job success. Build a record of work experience K1 to K4												
CO3	Explore ca	reer altern	atives by I	ntegrating	theory and	practical			K	1 to K4			
CO4	Expose the student to professional role models by developing communication, interpersonal and other critical skills									1 to K4			
CO5	Examine e	mployer-v	alued skills	s such as te	eamwork a	nd work co	ompletion		K	1 to K4			
MAPP	ING WITH	PROGR	AM OUT	COMES:									
CO/P	D PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	S	S	S	S	S	M	S	М			
CO2	М	S	S	S	М	S	S	М	М	М			
CO3	S	S	S	М	S	S	S	М	S	M			
CO4	S	S	S	S	S	S	S	М	М	M			
CO5	S	М	S	S	S	S	S	S M M S					
	S- STRON	IG			M – MEC	DIUM			L - LO	W			

CO / PO MAPPING:										
COS	PSO1	PSO2	PSO3	PSO4	PSO5					
CO1	3	3	3	3	3					
CO2	3	3	3	3	3					
CO3	3	3	3	3	3					
CO4	3	3	3	3	3					
CO5	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					



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Organic Chemistry - II			
Course Code	23UCHCC61	L+T	Р	С
Category	Core	4+1	-	3
COUDER OD IE				

COURSE OBJECTIVES:

This course aims at providing knowledge on

- > classification, isolation and discussing the properties of alkaloids and terpenes
- > preparation and properties of saccharides
- ➢ biomolecules
- different molecular rearrangement
- > preparation and properties of organometallic compounds

UNIT - I Alkaloids and Terpenes

Alkaloids Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine.

Terpenes: Classification, Isoprene rule, isolation and structural elucidation of Citral, Menthol, Geraniol

UNIT - II Carbohydrates

Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples.

Monosaccharides– configuration – D and L hexoses – aldohexoses and ketohexoses. Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses. Interconversions of sugar series aldose to ketose and ketose to aldose.

Disaccharides – sucrose, - preparation, properties and uses (no structural elucidation). lactose, maltose (Structure)

Polysaccharides - Source, constituents and biological importance of homopolysaccharides- starch and cellulose,

UNIT - III Molecular rearrangements:

Molecular Rearrangement: Type of rearrangements, Mechanism for Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement

12 + 3

12+3

12 + 3

catal	ysis- tools used like microwave and ultra-sound in chemical synthesis.	
	Total Lecture Hours	75
BOOI	KS FOR STUDY:	
\succ	M.K.Jain, S. C.Sharma, Modern Organic Chemistry, Vishal Publishing, 4th reprint,2009.	
	S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan Indi edition,2009	iaLtd., 3rd
	Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pv Multicolour edition,2012.	vt. Ltd.,
BOOP	KS FOR REFERENCES:	
\succ	R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia,6th edition, 20)12
\succ	T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons,11th edition, 2012.	
	A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi,7t edition,2009	h
WEB	RESOURCES:	
*	https://onlinecourses.nptel.ac.in/noc24_cy60/preview	
*	https://onlinecourses.nptel.ac.in/noc24_cy46/preview	
*	https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/127	

Organometallic compounds in Organic Synthesis Preparation, Properties and applications: Grignard

Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media – green solvents, green reagents and catalysts; Solvent free

Nature of Course	EMPLOYABILITY			\checkmark	SKILL OR	IENTED		ENTRE	ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL REGIONAL			NATION	AL	GLOBAL		\checkmark			
Changes Made in the Course	Percentage of Change			80	No Char	nges Made			New Course		
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.											

UNIT - IV Special reagents in organic synthesis

AIBN, BINAP/BINOL, DCC, DIBAL, NMP, PCC, TBHP

Reagents, Ziegler - Natta, Wilkinson, Zeiss's Salt

Green Chemistry

UNIT - V

12+3

COURS	SE OUTC	OMES:							K	LEVEL	
After s	After studying this course, the students will be able to:										
CO1	explain iso	olation and	properties	of alkaloid	is and terpe	enes			K	1 to K4	
CO2	explain preparation and reactions of mono and disachharides										
CO3	classify biomolecules and natural products based on their structure, properties, reactions and uses.										
CO4	explain molecular rearrangements like benzidine, Hoffmann etc.,										
CO5	preparation	n and prope	erties of or	ganolithiu	m compour	ıds			K	1 to K4	
MAPPI	NG WITH	I PROGR	AM OUT	COMES:							
CO/PC	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	S	S	S	S	S	S	S	Μ	S	Μ	
CO2	M	S	S	S	Μ	S	S	Μ	M	Μ	
CO3	S	S	S	Μ	S	S	S	Μ	S	M	
CO4	S	S	S	S	S	S	S	Μ	Μ	M	
CO5	S	M	S	S	S	S	S	Μ	M	S	
5	S- STROM	1G			M – MED	IUM			L - LO	W	
CO / P	O MAPPI	NG:			_						
C	os	PSO1]	PSO2	PSC)3	PSO4	ŀ	PSC	95	
C	01	3		3	3		3		3		
C	02	3		3	3		3		3		
C	03	3		3	3		3		3		
C	04	3		3	3		3		3		
C	05	3		3	3		3		3		
Weig	htage	ntage 15 15					15		15	;	
Weig percen Con Contri to	ghted Itage of Irse Ibution Pos	3.0		3.0	3.0	D	3.0		3.()	

LESSC	ON PLAN:		
UNIT	Organic Chemistry - II	HRS	PEDAGOGY
	Alkaloids Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine.	6	Chalk & talk
I	Terpenes: Classification, Isoprene rule, isolation and structural elucidation of Citral, Menthol,-Geraniol	6	Chalk & talk
	Solved problems	3	Group discussion
II	Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples. Monosaccharides– configuration – D and L hexoses – aldohexoses and ketohexoses. Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses. Interconversions of sugar series aldose to ketose and ketose to aldose.	8	Chalk & talk, PPt
	Disaccharides – sucrose, - preparation, properties and uses (no structural elucidation). lactose, maltose (Structure) Polysaccharides – Source, constituents and biological importance of homopolysaccharides- starch and cellulose,	4	Chalk & talk, PPt
	Solved problems	3	Group discussion
	Molecular Rearrangement: Type of rearrangements, Mechanism for Favorskii, Clasien, Fries, Hofmann	6	Chalk & talk, PPt
III	Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement	6	Chalk & talk, PPt
	Solved problems	3	Group discussion
	AIBN, BINAP/BINOL, DCC, DIBAL,NMP, PCC, TBHP		Chalk & talk, PPt
IV	Organometallic compounds in Organic Synthesis Preparation, Properties and applications: Grignard Reagents, Ziegler – Natta, Wilkinson ,Zeiss's Salt		Chalk & talk, PPt
	Solved problems	3	Group discussion
	Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media – green solvents,		Chalk & talk, PPt
v	green reagents and catalysts; Solvent free catalysis- tools used like microwave and ultra-sound in chemical synthesis.		Chalk & talk, PPt
	Solved problems	3	Group discussion

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print								
	A	Articulation Mapping	– K Levels w	ith Cours	e Outcomes (COs	5)		
			Section	n A	Section B			
Internal	Cos	K Level	MCQ	2s	Either or	Section C		
Internar	000		No. of. Questions	K - Level	Choice	Either or Choice		
CI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)		
AI	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)		
CI	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)		
AII	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)		
1		No. of Questions to be asked	4		4	4		
Quest	tion	No. of Questions to be answered	4		2	2		
CIA I & II	& II	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 %				
	K1	2	-	-	2	3.57	25				
	K2	2	10	-	12	21.43					
CIA	K3	-	10	16	26	46.43	46.43				
Ι	K4	-	-	16	16	28.57	28.57				
	Marks	4	20	32	56	100	100				
	K1	2	-	-	2	3.57	25				
~~ (K2	2	10	-	12	21.43					
CIA	K3	_	10	16	26	46.43	46.43				
11	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)									
			Section A (MCQs)		Section B (Either / or	Section C (Either / or			
S. No	COs	K - Level	No. of		Choice) With	Choice) With			
			Questions	K – Level	K - LEVEL	K - LEVEL			
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)			
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)			
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)			
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)			
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)			
No. of Q	uestions to	be Asked	10		10	10			
No. of Que	estions to	be answered	10		5	5			
Marks for each question		1		5	8				
Total Marks for each section		10		25	40				
	(Fig	ires in naren	thesis denotes.	questions sho	uld be asked with the give	en K level)			

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

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

Summative Examinations - Question Paper – Format

Answer A	LL the quest	tions	•	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 ALI	the question	ns		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		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Inorganic Chemistry – II									
Course Code	23UCHCC62	L	Р	С						
Category	Core	4+1	-	3						
COURSE OBJE	CTIVES:									
The course aims tracer eleme iron transpor metallo enzy silicates and industrial ap	 The course aims to provide knowledge on tracer elements and their role in the biological system. iron transport and storage metallo enzymes, oxygen transport. silicates and their applications industrial applications of refractories alloys paints and pigments 									
UNIT - I Bi	oinorganic Chemistry		1	2+3						
Essential and trace Effect of excess int	elements: Role of Na+, K+, Mg ²⁺ , Ca ²⁺ , Fe ³⁺ , Cu ²⁺ and Zn ²⁺ in bio ake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg.	ological	systems	•						
UNIT - II M	etal ion transport and storage		1	2+3						
Iron – storage, tran transport - Bohr eff	sport - Transferrin and Ferretin; Iron-porphyrins – myoglobin, h ect; Sodium/potassium pump, calcium pump; transport and storage	aemoglo e - coppo	bin – c er and z	oxygen inc.						
UNIT - III M	etallo enzymes		1	2+3						
Isomerase and sy Metalloenzymes -	nthetases, structure of cyanocobalamin (Vitamin B12), nat	ure of	Co-C	bond; Zn-Cu						

Metalloenzymes - functions of carboxy peptidase A, zinc metalloenzyme – mechanism and uses, Zn-Cu enzyme - structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferridoxin, Invivo and Invitro nitrogen fixation – biological functions of nitrogenase and molybdo enzymes.

UNIT - IV Silicates

Introduction – general properties of silicates, structure – types of silicates – ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates (pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)

UNIT - V Industrial Applications of Inorganic Compounds

Refractories, explosives. Alloys (steel, bronze, brass, Nichrome), Paints- requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti- skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels.

Nanocomposite Hydrogels: synthesis, characterization and uses.

Total Lecture Hours 75

12 + 3

12 + 3

BOOKS FOR STUDY:

- Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th ed., Milestone Publishers & Distributors, Delhi.
- Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi
- > Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London.

BOOKS FOR REFERENCES:

- Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded., S.Chand and Company, New Delhi.
- Gopalan R, (2009) Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited, Hyderabad
- Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

WEB RESOURCES:

- https://onlinecourses.nptel.ac.in/noc22_cy38/preview
- https://onlinecourses.nptel.ac.in/noc22_cy12/preview

Nature of Course	EMPLOYABILITY			\checkmark	SKILL OR	IENTED	E	ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGI	REGIONAL		NATION	AL		GLOBAL	\checkmark
Changes Made in the Course	Percentage of Change		40	No Chan	ges Made			New Course		

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

COURS	E OUTC	OMES:							K	LEVEL	
After st	tudying	this cou	rse, the s	students	s will be	able to:					
CO1	ability to e	xplain the	importance	e of tracer	elements o	n biologica	al system.		K	1 to K4	
CO2	explain the	e metal ion	transport,	Bohr effec	et, Na, K, C	'a pump.			K	1 to K4	
CO3	explain the	e function o	of Vitamin	B12, Zn-C	Cu enzyme,	ferredoxi	n, cluster e	nzymes.	K	1 to K4	
CO4	classification and structure of silicates. K1 to K										
CO5	explain the manufacture of refractories, explosives, paints and pigments K1 to K4										
MAPPI	NG WITH	PROGR	AM OUT	COMES:							
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	S	S	S	S	S	S	S	Μ	S	Μ	
CO2	Μ	S	S	S	Μ	S	S	Μ	Μ	Μ	
CO3	S	S	S	Μ	S	S	S	Μ	S	Μ	
CO4	S	S	S	S	S	S	S	M	Μ	M	
CO5	S	M	S	S	S	S	S	Μ	Μ	S	
S	S- STRON	STRONG M – MEDIUM L - LO									

CO / I	PO MAPP	ING:						
C	os	PSO1	PSO2	PSO3	PSO4		PSO5	
C	01	3	3	3	3		3	
C	:02	3	3	3	3	3		
C	03	3	3	3	3		3	
C	04	3	3	3	3		3	
C	05	3	3	3	3		3	
Weig	ghtage	15	15	15	15		15	
Weighted percentage of Course Contribution to Pos		3.0	3.0	3.0	3.0		3.0	
LESSC	ON PLAN:							
UNIT		Inor	2. 2.	HRS	PEDAGOGY			
	Essential and Zn ²⁺ i	and trace eleme n biological sys	Fe^{3+}, Cu^{2+}	6	Chalk & talk, PPt			
I	Effect of Cd, Pb, H	excess intake (7	6	Chalk & talk, PPt				
	Solved pr	oblems				3	Group Discussions	
	Iron – sto myoglobir	orage, transport n, haemoglobin	- Transferrin an – oxygen transpo	d Ferretin; Iron-po rt - Bohr effect;	orphyrins –	6	Chalk & talk, PPt	
II	Sodium/po and zinc.	tassium pump,	calcium pump;	transport and stor	age - coppe	6	Chalk & talk, PPt	
	Solved pr	oblems				3	Group Discussions	
	Isomerase nature of A, zinc structure a	and synthetase Co-C bond; Me metalloenzyme and function, car	s, structure of cya talloenzymes - fu – mechanism a bonic anhydrase	anocobalamin (Vit unctions of carbox) and uses, Zn-Cu	amin B12), y peptidase enzyme -	6	Chalk & talk, PPt	
III	Vitamin H 2Fe-2S – fixation –	3-12 as transfe rubredoxin, 4F biological funct	rase and isomera e-2S – ferridoxin tions of nitrogena	ase - Iron-sulphur a, Invivo and Invit se and molybdo en	proteins - ro nitrogen zymes	6	Chalk & talk, PPt	
	Solved pr	oblems				3	Group Discussions	
	Introductions silicates - silicates (p	- types of ite), chain	6	Chalk & talk, PPt				
IV	ring silicat three dime	tes(beryl), sheet nsional structur	icates having	6	Chalk & talk, PPt			
	Solved pr	oblems	k			3	Group Discussions	
V	Refractori	es, explosives.	Alloys (steel,	bronze, brass,	Nichrome),	6	Chalk & talk,	

Nanocomposite Hydrogels: synthesis, characterization and uses.		PPt
Paints- requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti- skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels.	6	Chalk & talk, PPt
Solved problems	3	Group Discussions

	Learning Outcome Based Education & Assessment (LOBE)										
		Formativ	ve Examination	on - Blue l	Print						
	A	Articulation Mapping	– K Levels w	ith Cours	e Outcomes (COs	5)					
			Section	n A	Section B	Section C Either or Choice					
Internal	Cos	K L ovol	MCQ)s	Fither or						
	CUS	K Level	No. of.	K -	Choice						
			Questions	Level	Choice						
CI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)					
AI	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)					
CI	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)					
AII	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)					
		No. of Questions to be asked	4		4	4					
Quest	tion	No. of Questions to be answered	4		2	2					
Pattern CIA I & II		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	K1	2	-	-	2	3.57	25					
	K2	2	10	-	12	21.43						
	K3	-	10	16	26	46.43	46.43					
I	K4	-	-	16	16	28.57	28.57					
-	Marks	4	20	32	56	100	100					
	K1	2	-	-	2	3.57	25					
	K2	2	10	-	12	21.43						
CIA	K3	_	10	16	26	46.43	46.43					
Π	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

Academic Council Meeting Held On 17.04.2025

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.

Summati	Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)									
			Section A	(MCQs)	Section B (Either / or	Section C (Either / or				
S. No	COs	K - Level	No. of	K Loval	Choice) With	Choice) With				
			Questions	K – Level	K - LEVEL	K - LEVEL				
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)				
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)				
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)				
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)				
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)				
No. of Q	uestions to	be Asked	10		10	10				
No. of Que	estions to l	be answered	10		5	5				
Marks for each question		1		5	8					
Total Marks for each section		10		25	40					
	(Figu	ires in parent	thesis denotes, d	questions show	ild be asked with the give	en K level)				

	Distribution of Marks with K Level											
K Level	Section A (Multiple Choice Questions)	Section A (Multiple Choice Questions) Section B (Either or Choice		Total Marks	% of (Marks without choice)	Consolidated %						
K1	5	-	-	5	3.57	21.43						
K2	5	20	-	25	17.86	20						
K3	-	20	48	68	48.57	48.57						
K4	-	10	32	42	30	30						
Marks	10	50	80	140	100	100						
NUE TTO I	1 0 0											

NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.

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

Summative Examinations - Question Paper – Format

Answer A	LL the quest	tions		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 ALI	the question	ns		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								

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Physical Chemistry - II								
Course Code	23UCHCC63	L+T	Р	С					
Category	Core 5+1 - 4								
COURSE OBJECTIVES: The course aims at providing an overall view of the									
phase diagra	> phase diagram of one and two component systems								

- > chemical equilibrium,
- > separation techniques for binary liquid mixtures.
- > electrical conductance and transport number.
- > galvanic cells, EMF and significance of electrochemical series

UNIT - I Phase rule

Definition of terms; derivation of phase rule ; application to one component systems – water ; two component systems – solid liquid equilibria- simple eutectic (lead - silver), freezing mixtures (potassium iodide- water), compound formation with- congruent melting points (magnesium – zinc), peritectic change (sodium – potassium), solid solution -copper sulphate – water system.

UNIT - II Chemical equilibrium

Law of mass action – thermodynamic derivation – relationship between Kp and Kc –application to the homogeneous equilibria – dissociation of PCl_5 gas, N_2O_4 gas –equilibrium constant and degree of dissociation - formation of HI, and NH_3 –heterogeneous equilibrium – decomposition of solid calcium carbonate –Lechatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – ClausiusClayperon equation and its applications

UNIT - III Binary liquid mixtures

Ideal liquid mixtures – non ideal solutions – azeotropic mixtures – fractional distillation – partially miscible mixtures – phenol-water, triethylamine-water, effect of impurities on critical solution temperature; immiscible liquids- steam distillation; Nernst distribution law – applications.

UNIT - IV Electrical Conductance and Transference

Arrhenius theory of electrolytic dissociation – Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Wien effect. Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device), transport number –determination – Hittorf's method,; Kohlrausch's law- applications; applications of conductance measurements- ionic product of water, solubility and solubility product of sparingly soluble salts - conductometric titrations – acid base titrations.

15+3

15+3

15+3

15 + 3

UNIT - V Galvanic Cells and Applications

Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction, thermodynamics and EMF – calculation of ΔG , ΔH , and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electrochemical series. potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate. Fuel cells – **Proton Exchange membrane fuel Cell – Polarization performance.**

Corrosion -mechanism (Fe alone), types and methods of prevention (electroplating & sacrificial anode).

Total Lecture Hours 75

BOOKS FOR STUDY:

- B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021.
- > ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co.
- Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
- Allen.J. Bard Electrochemistry

BOOKS FOR REFERENCES:

- K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009.
- Silbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985.
- D.N.Bajpai, Advanced Physical Chemistry, S.Chand&Co., 2001

WEB RESOURCES:

- https://onlinecourses.nptel.ac.in/noc23_cy19/preview
- https://onlinecourses.nptel.ac.in/noc19_ch25/preview

Nature of Course	EMPLOYABILITY			\checkmark	SKILL OR	IENTED		ENTREPRENEURSHIP		>
Curriculum Relevance	LOCAL	L REGIONAL NATIONAL			GLOBAL	\checkmark				
Changes Made in the Course	Percentag	e of Ch	ange	ge 60 No Changes Made New Cou			New Course			
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.										

Academic Council Meeting Held On 17.04.2025

COURS	SE OUTC	OMES:							K	LEVEL
After studying this course, the students will be able to:										
CO 1	construct to properties solutions.	the phase di of freezing	agram fo mixture	or one comp , component	onent and t with cong	two compo ruent melt	onent syster ing points a	ns, explai	in the	1 to K4
CO2	apply the concepts of chemical equilibrium in dissociation of PCl ₅ , N ₂ O ₄ and formation of HI, NH ₃ , SO ₃ and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation.									
CO3	Identify an such as az	n appropria eotropic mi	te distilla xtures, p	tion method artially mise	for the sep ble mixtu	paration of res and im	binary liqu miscible li	uid mixtu quids.	res K	1 to K4
CO4	Explain th and Kohlr	e significar ausch's law	ice of Ai	rhenius theo uctance.	ory, Debye-	Huckel the	eory, Onsa	ger equati	ion K	1 to K4
CO5	Construct EMF. Der	electrocher nonstrate th	nical cel	l with the he ations of EN	lp of electr IF and sign	ochemical ificance of	series and f potentiom	calculate etric titra	cell tions.	1 to K4
MAPPI	NG WITH	I PROGR	AM OU	TCOMES:						
CO/PC	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	Μ	S	M
CO2	Μ	S	S	S	M	S	S	Μ	M	M
CO3	S	S	S	Μ	S	S	S	Μ	S	M
CO4	S	S	S	S	S	S	S	Μ	M	M
CO5	S	Μ	S	S	S	S	S	Μ	M	S
	S- STROI	NG			M – MEC	IUM			L - LO	W
CO / P	O MAPP	ING:			1					
С	os	PSO1		PSO2	PSC	03	PSO4		PSO5	
C	D 1	3		3	3		3		3	
C	02	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		
WEITAGE 15				15	1	5	15		15	5
WEIG PERCE OF CO CONT ON T	HTED NTAGE DURSE RIBUTI O POS	3.0		3.0	3.	0	3.0		3.0)

LESSC	ON PLAN:		
UNIT	Physical Chemistry - II	HRS	PEDAGOGY
	Definition of terms; derivation of phase rule ; application to one component systems – water ; two component systems – solid liquid equilibria- simple eutectic (lead - silver),	7	Chalk & talk, ppt
Ι	Freezing mixtures (potassium iodide- water), compound formation with- congruent melting points (magnesium – zinc), peritectic change (sodium – potassium), solid solution -copper sulphate – water system.	8	Chalk & talk, ppt
	Solved Problems	3	Group Discussion
	Law of mass action – thermodynamic derivation – relationship between Kp and Kc –application to the homogeneous equilibria – dissociation of PCl5 gas,N2O4 gas –equilibrium constant and degree of dissociation - formation of HI, and NH3	7	Chalk & talk, ppt
п	heterogeneous equilibrium – decomposition of solid calcium carbonate –Lechatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – ClausiusClayperon equation and its applications	8	Chalk & talk, ppt
	Solved Problems	3	Group Discussion
III	Ideal liquid mixtures – non ideal solutions – azeotropic mixtures – fractional distillation – partially miscible mixtures – phenol-water, triethylamine-water	8	Chalk & talk, ppt
	effect of impurities on critical solution temperature; immiscible liquids- steam distillation; Nernst distribution law – applications.	7	Chalk & talk, ppt
	Solved Problems	3	Group Discussion
	Arrhenius theory of electrolytic dissociation – Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Wien effect	7	Chalk & talk, ppt
IV	Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device), transport number –determination – Hittorf's method,; Kohlrausch's law- applications; applications of conductance measurements- ionic product of water, solubility and solubility product of sparingly soluble salts - conductometric titrations – acid base titrations.	8	Chalk & talk, ppt
	Solved Problems	3	Group Discussion
v	Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction, thermodynamics and EMF – calculation of ΔG , ΔH , and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential,	6	Chalk & talk, ppt
	primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode.	9	Chalk & talk, ppt

Solved Problems	3	Group Discussion
 precipitation titrations, redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate. Fuel cells – Proton Exchange membrane fuel Cell – Polarization performance. Corrosion –mechanism (Fe alone), types and methods of prevention (electroplating & sacrificial anode). 		
redox electrode; electrochemical series – applications of electrochemical series, potentiometric titrations – acid base titrations, redox titrations.		

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

Distribution of Marks with K Level CIA I & CIA II								
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %	
	K1	2	-	-	2	3.57	25	
	K2	2	10	-	12	21.43		
СТА	K3	-	10	16	26	46.43	46.43	
I	K4	-	-	16	16	28.57	28.57	
-	Marks	4	20	32	56	100	100	
	K1	2	-	-	2	3.57	25	
	K2	2	10	-	12	21.43		
CIA	K3	_	10	16	26	46.43	46.43	
II	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)								
			Section A	(MCQs)	Section B (Either / or	Section C (Either / or		
S. No	COs	K - Level	No. of	K – Level	Choice) With	Choice) With		
			Questions		K - LEVEL	K - LEVEL		
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)		
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)		
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)		
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)		
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,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	20	
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.							
Q. No.	Unit	CO	K-level				
----------	--------------	------------	---------	----------	------------------------		
Answer A	LL the quest	tions]	PART – A	(10 x 1 = 10 Marks)		
	Unit - I	CO1	K1				
1.				a)	b)		
				c)	d)		
	Unit - I	CO1	K2				
2.				a)	b)		
				c)	d)		
	Unit - II	CO2	K1				
3.				a)	b)		
				c)	d)		
	Unit - II	CO2	K2				
4.				a)	b)		
				c)	d)		
	Unit - III	CO3	K1				
5.				a)	b)		
				c)	d)		
	Unit - III	CO3	K2				
6.				a)	b)		
				c)	d)		
	Unit - IV	CO4	K1				
7.				a)	b)		
				c)	d)		
	Unit - IV	CO4	K2				
8.				a)	b)		
				c)	d)		
	Unit - V	CO5	K1				
9.				a)	b)		
				c)	d)		
	Unit - V	CO5	K2				
10.				a)	b)		
				c)	d)		

Summative Examinations - Question Paper – Format

Answer A	Answer ALL the questions			ART – 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	ver 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						

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	ne Physical Chemistry Practical – II								
Course Code	23UCHCP61	L	Р	С					
Category	Core Practical - 3								
 COURSE OBJECTIVES: This course aims at providing basic principles of physical chemistry experiments hands on experience in carrying out the experiments 									
UNIT - I Ph	nase diagrams			15					
Simple eutectic - determination of eutectic temperature and composition of naphthalene- diphenyl amine or naphthalene-diphenyl system Determination of transition temperature of a salt hydrate. Determination of upper critical solution temperature of phenol – water system Effect of an electrolyte on miscibility temperature of phenol – water system Determination of concentration of sodium chloride using phenol- sodium chloride system									
UNIT - II Di	stribution law			15					
Determination of the distribution coefficient of iodine between carbon tetrachloride and water. Determination of equilibrium constant of the reaction $I_2 + I \rightarrow I_3$ Determination of concentration of the given potassium iodide solution using the above equilibrium constant									
UNIT - III El	ectrochemistry			15					
Conductometric titra Potentiometric titra	Conductometric titration of hydrochloric acid against sodium hydroxide Potentiometric titration of ferrous ion against potassium dichromate using quinhydronde electrode.								
	Total Practical Ho	ours		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.

Nature of Course	EMPLOYABILITY			SKILL ORIENTED		\checkmark	ENTRE	PRENEURSHI	•	
Curriculum Relevance	LOCAL REGI		ONAL	√	NATIONAL			GLOBAL		
Changes Made in the Course	Percentage of Change				No Cha	nges Made			New Course	\checkmark

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

COURS	E OUTC	OMES:							K	LEVEL
After st	tudying this course, the students will be able to:									
CO1	Describe t	cribe the principles and methodology for the practical work.								
CO2	Explain the procedure, data and methodology for the practical work K1									1 to K4
CO3	Apply the principles of phase rule and electrochemistry for carrying out the practical work									1 to K4
CO4	Demonstra	ate laborato	ry skills fo	or safe hand	dling of the	e equipment	nt and chen	nicals	K	1 to K4
CO5	Access								K	1 to K4
MAPPI	NG WITH	PROGR	AM OUT	COMES:					Y.	
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	Μ	S	Μ
CO2	M	S	S	S	Μ	S	S	M	Μ	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	Μ	M
CO5	S	M	S	S	S	S	S	M	Μ	S
S	S- STRON	IG			M – MED	IUM			L - LO	V
CO / P	O MAPPI	NG:								
C	DS	PSO1]	PSO2	PSC	03	PSO4		PSO5	
C	01	3		3	3		3		3	
C	02	3		3	3		3		3	
C	03	3		3	3		3		3	
C	04	3		3	3		3		3	
Weig	htage	12	12		12	2	12		12	
Weig percen Cou Contri	hted tage of irse bution	3.0		3.0	3.	0	3.0		3.0)

to	PSOs								
LESSO	N PLAN:								
UNIT	Physical Chemistry Practical - II HRS PEDAGOGY								
	 Simple eutectic - determination of eutectic temperature and composition of naphthalene- diphenyl amine or naphthalene- diphenyl system Determination of transition temperature of a salt hydrate. 	7	Chalk & talk, experiment						
I	 Determination of upper critical solution temperature of phenol – water system Effect of an electrolyte on miscibility temperature of phenol – water system Determination of concentration of sodium chloride using phenol- sodium chloride system 	8	Chalk & talk, experiment						
п	 Determination of the distribution coefficient of iodine between carbon tetrachloride and water. Determination of equilibrium constant of the reaction I₂ + I→ I₃ 	9	Chalk & talk, experiment						
	• Determination of concentration of the given potassium iodide solution using the above equilibrium constant.	6	Chalk & talk, experiment						
TTT	• Conductometric titration of hydrochloric acid against sodium hydroxide	3	Chalk & talk, experiment						
111	• Potentiometric titration of ferrous ion against potassium dichromate using quinhydronde electrode.	3	Chalk & talk, experiment						
	Exams	6	Exam						

	Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)								
Internal	COs	K Level	Section						
CO1		K1 – K4	1 (K4)						
Madal	CO2	K1 – K4	1 (K4)						
Niodel	CO3	K1 – K4	1 (K3)						
Exam	CO4	K1 – K4	1 (K4)						
	CO5	K1- K4	1 (K4)						
		No. of Questions to be asked	5						
Question Pattern		No. of Questions to be answered	5						
Mo	del exam	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)

Answer	ALL the qu	estions		(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	

Internal Examinations - Question Paper – Format

Summativ	Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs								
S.No	COs	K - Level	SECTION						

3. 1NO	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 Quest	ions to be Asked	5				
	No. of Questio	ons to be answered	5				
	Marks for	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 (15)*

*Student will not be allowed to do the Summative practical exam if record notebook is not validated by the internal examiner.

Summative Examinations - Question Paper – Format

Answer	ALL the qu	estions		(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	

15 marks to be awarded for proper record submission.

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Fundamentals of Spectroscopy							
Course Code	23UCHEC61	L+T	Р	С				
Category	Elective	4	-	3				
COURSE OBJECTIVES:								

This course is designed to provide knowledge on

- > electrical and magnetic properties of organic and inorganic compounds
- basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
- > instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
- > applications of various spectral techniques in structural elucidation
- > solving combined spectral problems

UNIT – I Microwave spectroscopy

Microwave spectroscopy Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications.

UNIT - II Ultraviolet and Visible spectroscopy

Electronic spectra of diatomic molecules– Frank Condon principle – dissociation in electronic transitions – BirgeSponer method of evaluation of dissociation energy – pre-dissociation transition - σ - σ *, π - π *, n- σ *, n- π * transitions. Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α , β - unsaturated ketones. Colorimetry - principle and applications (estimation of Fe3+)

UNIT - III Infrared spectroscopy & Raman Spectroscopy

Infrared spectroscopy

Vibration spectra –diatomic molecules – harmonic oscillator and anharmonic oscillator, Vibration – rotation spectra – diatomic molecule as rigid - selection rules, vibrations of polyatomic molecules – stretching and bending vibrations – applications – determination of force constant, moment of inertia and internuclear distance – isotopic shift – **interpretation** of IR spectra to simple molecules (ethanol, 2-bromo propane, cyclo hexane)

Raman Spectroscopy

Rayleigh scattering and Raman scattering of light – Raman shift – classical theory of Raman effect – quantum theory of Raman effect – Vibrational Raman spectrum – selection rules – mutual exclusion principle – instrumentation (block diagram) — interpretation of Raman spectra to simple molecules (dodecane, 1-decene, , hexyne)

12

12

UNIT – IV Nuclear magnetic resonance spectroscopy

¹H NMR – theory of ¹H NMR – instrumentation - number of signals – chemical shift – peak areas and proton counting – spin-spin coupling – applications. shielding and deshielding of protons, chemical shifts of protons in hydrocarbons, and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems.

UNIT - V Mass spectrometry

Principle – different kinds of ionisation – instrumentation – the mass spectrum – types of ions – fragmentation and structural elucidation – McLafferty rearrangement; Retro Diels Alder reaction – illustrations with simple organic molecules. Solving mass spectra (benzene, hexane)

Total Lecture Hours 60

BOOKS FOR STUDY:

- Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. Elements of Analytical Chemistry; S Chand: New Delhi, 2003.
- Banwell, C.N.; Mc Cash, E. M. Fundamentals of Molecular Spectroscopy, 4th ed.; Tata McGraw Hill, New Delhi, 2017.
- > B.K.Sharma, Spectroscopy,22nd ed., Goel Publishing House, 2011.

BOOKS FOR REFERENCES:

- Srivastava, A. K.; Jain, P. C. Chemical Analysis an Instrumental Approach, 3rded.; S.Chand, New Delhi, 1997.
- Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. Fundamentals of Analytical Chemistry, 9thed.; Harcourt college Publishers: USA, 2013.
- Puri, B. R.; Sharma, L. R.; Pathania, M.S. Principles of Physical Chemistry, 43rd ed.; Vishal Publishing: Delhi, 2008.

WEB RESOURCES:

https://onlinecourses.nptel.ac.in/noc20_cy08/preview

Nature of Course	EMPLOYABILITY				SKILL ORIENTED			ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL	AL REGIONAL				NATION	AL		GLOBAL	٦	\checkmark
Changes Made in the Course	Percentage of Change			No Char	iges Made			New Course		\checkmark	
* Treat 3	* Treat 20% as each unit (20*5–100%) and calculate the percentage of change for the course										

12

COUR	SE OUTC	OMES:									K LEV	EL
After st	udying this	s course, th	e stu	dents	s will be al	ble to:						
CO1	explain ele	ectrical and	mag	netic	properties	of material	s and mi	crowave spe	ctrosco	ору	K1 to	K4
CO2	explain the	eory, instru	ment	ation	and applic	ations of In	frared a	nd Raman sp	ectros	сору	K1 to	K4
CO3	apply selector for the cal	ction rules culation of	to un wave	dersta elengt	nd spectra h maximu	l transition n of conjug	s, explai gated die	n Woodward nes	– Fies	ser's rule	K1 to	K4
CO4	explain the	eory, instru	ment	ation	and applic	ations of N	MR spea	ctroscopy			K1 to	K4
CO 5	explain the	eory, instru	ment	ation	and applic	ations of M	lass spec	trometry			K1 to	K4
MAPPI	MAPPING WITH PROGRAM OUTCOMES:											
CO/PO	D PO1	PO2	P	03	PO4	PO5	P06	PO7	PO	8 PC	9 PO	10
CO1	S	S	S	5	S	S	S	S	Μ	S	N	1
CO2	Μ	S	S	5	S	M	S	S	Μ	M	N	Γ
CO3	S	S	S	5	Μ	S	S	S	Μ	S	N	Г
CO4	S	S	S	5	S	S	S	S	Μ	M	N	Г
CO5	S	М	S	5	S	S	S	S	Μ	М	S	3
	S- STROI	NG				M – MED	IUM			L - I	, ow	
CO / F	PO MAPPI	ING:										
С	os	PSO1 PSO2 PSO3 PSC				PSO4	-	Р	SO5			
C	01	3			3	3		3			3	
C	02	3			3	3		3	3			
С	03	3			3	3		3			3	
С	04	3			3	3		3		3		
С	05	3			3	3		3			3	
Weig	htage	15			15	15	5	15			15	
Weig percen Co Contr to	ghted ntage of urse ibution Pos	3.0			3.0	3.0)	3.0	3.0		3.0	
LESSO	N PLAN:											
UNIT		Fun	dam	enta	als of Sp	ectrosco	ру		HI	RS P	EDAGO	GY
I	I Microwave spectroscopy Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules determination of bond length, effect of isotopic substitution – instrumentation and applications						cules (rigid	e	6Chalk & talk, ppt6Chalk & talk, ppt		ष्ठ it ष्ठे	
Π	Electronic dissociation evaluation	spectra of on in ele of dissoci	f diat ctroni ation	comic ic tra energ	molecules ansitions gy – pre-di	s– Frank C – BirgeSj issociation	Condon poner r transitio	principle – nethod of n - σ - σ *,	6	5	Chalk & alk, pp	远 nt

	π - π *, n- σ *, n- π * transitions		
	Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α , β - unsaturated ketones. Colorimetry - principle and applications (estimation of Fe3+)	6	Chalk & talk, ppt
III	Infrared spectroscopy Vibration spectra –diatomic molecules – harmonic oscillator and anharmonic oscillator, Vibration – rotation spectra – diatomic molecule as rigid - selection rules, vibrations of polyatomic molecules – stretching and bending vibrations – applications – determination of force constant, moment of inertia and internuclear distance – isotopic shift – interpretation of IR spectra to simple molecules (ethanol, 2- bromo propane, cyclo hexane	6	Chalk & talk, ppt
	Raman Spectroscopy Rayleigh scattering and Raman scattering of light – Raman shift – classica theory of Raman effect – quantum theory of Raman effect – Vibrationa Raman spectrum – selection rules – mutual exclusion principle instrumentation (block diagram) — interpretation of Raman spectra to simple molecules (dodecane, 1-decene, , hexyne)	6	Chalk & talk, ppt
117	¹ H NMR – theory of ¹ H NMR – instrumentation - number of signals – chemical shift – peak areas and proton counting – spin-spin coupling – applications. shielding and deshielding of protons	6	Chalk & talk, ppt
10	chemical shifts of protons in hydrocarbons, and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems.	6	Chalk & talk, ppt
V	Principle – different kinds of ionisation – instrumentation – the mass spectrum – types of ions - fragmentation and structural elucidation – McLafferty rearrangement	6	Chalk & talk, ppt
	Retro Diels Alder reaction - illustrations with simple organic molecules. Solving mass spectra (benzene, hexane)	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 L ovol	Section MC(n A Qs	Section B	Section C Either or Choice				
	COS	K Level	No. of. Questions	K - Level	Choice					
CI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)				
AI	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)				
CI	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)				
AII	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)				
H		No. of Questions to be asked	4		4	4				
Quest	tion	No. of Questions to be answered	4		2	2				
CIA I & II		Marks for each question	1		5	8				
		Total Marks for each section	4		10	16				

		Dis	tribution of	Marks with	K Level	CIA I & CIA I	I
	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 %
	K1	2	-	-	2	3.57	25
СТА	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
I	K4	-	-	16	16	28.57	28.57
-	Marks	4	20	32	56	100	100
	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
CIA	K3	_	10	16	26	46.43	46.43
II	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.

Summat	Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)										
			Section A	(MCQs)	Section B (Either / or	Section C (Either / or					
S. No CO	COs	K - Level	No. of	K – Level	Choice) With	Choice) With					
			Questions		K - LEVEL	K - LEVEL					
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)					
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)					
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)					
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)					
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)					
No. of Q	uestions to	be Asked	10		10	10					
No. of Que	estions to l	be answered	10		5	5					
Marks for each question		juestion	1		5	8					
Total Marks for each section		10		25	40						
	(Figu	ires in paren	thesis denotes,	questions show	uld be asked with the give	en 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	20					
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.											

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

Summative Examinations - Question Paper – Format

Answer A	LL the que	stions		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 AL	L the question	ons		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								

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Nanoscience			
Course Code	23UCHEC62	L	Р	С
Category	Elective	4	-	3
COURSE OBJEC This course aim	CTIVES: is at providing knowledge on			
Category COURSE OBJEC This course aim	Elective CTIVES: as at providing knowledge on to percenticles/clusters and percentration	4	-	3

- introduction to nanoparticles/clusters and nanocomposites
- > properties of nanomaterials
- > characterization of nanomaterials by different methods
- > synthesis of carbon nanotubes, graphene, quantum dots, self- assembled nanomaterials
- > applications of nanomaterials as sensors

UNIT - I Introduction to nanoscience

Definition of terms – nanomaterials, clusters, quantum dots and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials. Synthesis of nanomaterials- Top down approach (physical methods), ball milling, CVD and PVD, ion sputtering, nanolithography. Bottom–up approach (chemical methods) - solvothermal synthesis, sonochemical synthesis, electro deposition, sol-gel method, reducing agents and oxidising agents, capping agents-stabilization of nanomaterials.

UNIT - II Properties of materials on a nanoscale

Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe3O4 nanomaterials, ion/electron conductivity, thermal property, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, surface to volume ratio- mechanical properties.

UNIT - III Techniques employed for characterisation of nanomaterials 12

Spectrocopy – UV-visible, X-ray Photoelectron spectroscopy (**XPS**) – Electron microscopy – Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM),– Atomic Force Microscopy (AFM), X-ray diffraction (XRD) [Principle and Block diagram only].

UNIT - IV Special nanomaterials

Carbon Nano Structures-Carbon nanotubes: Introduction - types - zigzag, armchair, helical, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission. Other Important Carbon based materials: Preparation and Characterization of Graphene, properties, Applications of Semiconductor nanoparticles: Quantum dots, synthesis – chemical synthesis using clusters, properties, Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS)

12

12

UNIT – V Application of nanomaterials

Biomedical Applications- drug, drug delivery, cancer treatment. Sensors – Natural nanoscale sensors, chemical sensors, biosensors, OLED, energy conversion and storage. Nanotechnology in agriculture – Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials-labelling, fabric industry. Impacts of Nanotechnology – human & environmental safety risks.

Total Lecture Hours

60

BOOKS FOR STUDY:

- Sulabha K. Kulkarni, Nanotechnology: Principles and Practices, Capital Publishing Co., New Delhi.
- Pradeep. T, Nano: The Essentials, Understanding Nanoscience and Nanotechnology; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007.
- Shah. M.A.; Tokeer Ahmad, Principles of Nanoscince and Nanotechnology; Narosa Publishing House, New Delhi, 2010.

BOOKS FOR REFERENCES:

- Sharma. P.K., Understanding Nanotechnology; Vista International Publishing House, Delhi. 2008.
- Charles P. Poole Jr.; Frank J. Owens. Introduction to Nanotechnology; A John Wiley & Sons, INC., Publication, 2003.
- Viswanathan B., Nano Materials; Narosa Publishing House, New Delhi, 2009.

WEB RESOURCES:

- http://www.nanotechnology.com/docs/wtd015798.pdf
- http://nccr.iitm.ac.in/Nanomaterials.pdf

Nature of Course	EMPLOYABILITY			\checkmark	SKILL OR	IENTED		ENTREPRENEURSHIP		D
Curriculum Relevance	LOCAL		REGI	ONAL	,	NATION	AL		GLOBAL	
Changes Made in the Course	Percentage of Change			50	No Char	iges Made		New Course		
* Treat 2	20% as eac	h unit	(20*5=1	00%)	and calcula	ate the perce	entage	e of chan	ige for the cou	rse.

Academic Council Meeting Held On 17.04.2025

COURS	E OUTC	OMES:]	K LEVEL		
After st	tudying	this cour	rse, the	students	s will be	able to:						
CO1	explain the nanosciene	e general co ce.	oncepts an	d physical	phenomena	a of releva	nce within	the field o	of]	K1 to K4		
CO2	describe th and applic	ne propertie ations.	es, synthes	is, characte	eristics of n	anomateri	als, special	nanomate	erials	K1 to K4		
CO3	examine th	ne structure	, propertie	es, applicab	oility and cl	naracteriza	tion of nar	omaterials	s.]	K1 to K4		
CO4	analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene K1 to K4											
CO5	discuss applications of nanomaterials of sensors and in optics and electronics K1 to K4											
MAPPING WITH PROGRAM OUTCOMES:												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
CO1	S	S	S	S	S	S	S	Μ	S	Μ		
CO2	M	S	S	S	Μ	S	S	Μ	Μ	Μ		
CO3	S	S	S	Μ	S	S	S	М	S	Μ		
CO4	S	S	S	S	S	S	S	Μ	Μ	Μ		
CO5	S	М	S	S	S	S	S	Μ	Μ	S		
S	S- STROI	1G			M – MED	IUM			L - L(W		
CO / P	O MAPPI	NG:	_		1							
C	DS	PSO1		PSO2	PSC	03	PSO4			05		
C	01	3		3	3		3		3			
C	02	3		3	3		3		(3		
C	03	3		3	3		3		:	3		
C	04	3		3	3		3		3	3		
C	05	3		3	3		3		÷	3		
Weig	htage	15 15 15 15 1							1	5		
Weig percen Cou Contri t PS	hted tage of irse bution o Os	3.0		3.0	3.0		3.0		3	.0		

LESSC	ON PLAN:		
UNIT	Nanoscience	HRS	PEDAGOGY
Ŧ	Definition of terms – nanomaterials, clusters, quantum dots and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials. Synthesis of nanomaterials- Top down approach (physical methods), ball milling	6	Chalk & talk, ppt
1	CVD and PVD, ion sputtering, nanolithography. Bottom–up approach (chemical methods) - solvothermal synthesis, sonochemical synthesis, electro deposition, sol-gel method, reducing agents and oxidising agents, capping agents-stabilization of nanomaterials.	6	Chalk & talk, ppt
п	Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe3O4 nanomaterials	6	Chalk & talk, ppt
	ion/electron conductivity, thermal property, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, surface to volume ratio- mechanical properties.	6	Chalk & talk, ppt
	Spectrocopy – UV-visible, X-ray Photoelectron spectroscopy (XPS) – Electron microscopy – Scanning Electron Microscopy (SEM)	6	Chalk & talk, ppt
111	Transmission Electron Microscopy (TEM),– Atomic Force Microscopy (AFM), X-ray diffraction (XRD) [Principle and Block diagram only].	6	Chalk & talk, ppt
IV	Carbon Nano Structures-Carbon nanotubes: Introduction - types - zigzag, armchair, helical, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission. Other Important Carbon based materials: Preparation and Characterization of Graphene, properties	6	Chalk & talk, ppt
	Applications of Semiconductor nanoparticles: Quantum dots, synthesis – chemical synthesis using clusters, properties, Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS)	6	Chalk & talk, ppt
V	Biomedical Applications- drug, drug delivery, cancer treatment. Sensors – Natural nanoscale sensors, chemical sensors, biosensors, OLED, energy conversion and storage. Nanotechnology in agriculture	6	Chalk & talk, ppt
v	Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials-labelling, fabric industry. Impacts of Nanotechnology – human & environmental safety risks.	6	Chalk & talk, ppt

	Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)										
			Sectio	n A	Section B						
Internal	Cos	K Level	MCC	Qs	Either or	Section C					
Internar			No. of. Questions	K - Level	Choice	Either or Choice					
CI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)					
AI CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)						
CI	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)					
AII	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)					
	1	No. of Questions to be asked	4		4	4					
Quest	tion	No. of Questions to be answered	4		2	2					
Pattern CIA I & II	& II	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)	n B r / (Either / Or Choice)Section C Total Marks% of (Marks without choice)		Consolidate of %						
	K1	2	-	-	2	3.57	25					
	K2	2	10	-	12	21.43						
CIA	K3	-	10	16	26	46.43	46.43					
Ι	K4	-	-	16	16	28.57	28.57					
	Marks	4	20	32	56	100	100					
	K1	2	-	-	2	3.57	25					
	K2	2	10	-	12	21.43						
CIA	K3	-	10	16	26	46.43	46.43					
11	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.

Summat	ive Exam	ination – B	lue Print Artic	culation Map	ping – K Level with Co	ourse Outcomes (COs)
			Section A	(MCQs)	Section B (Either / or	Section C (Either / or
S. No	COs	K - Level	No. of	K – Level	Choice) With	Choice) With
			Questions		K - LEVEL	K - LEVEL
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)
No. of Q	uestions to	be Asked	10		10	10
No. of Que	estions to l	be answered	10		5	5
Marks for each question		1		5	8	
Total Marks for each section		10		25	40	
	(Figu	ires in paren	thesis denotes,	questions show	uld be asked with the give	en 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	20						
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												
ieveis.												

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

Summative Examinations - Question Paper – Format

Answer A	LL the que	stions		PART – B	(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K2		
			<u>.</u>	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 AL	L the question	ons		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		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Polymer Science			
Course Code	23UCHEC63	L	Р	С
Category	Elective	4	-	3
COURSE OBJE	CTIVES:			

The course aims at providing an overall view of

- > classification of polymers, preparation of polymers
- kinetics of polymerization and characterization of polymers
- > analytical techniques used to characterize polymers
- > reactions of polymers
- > speciality polymers like PVC, PMMA

UNIT - I Introduction

Difference between polymer and macromolecule – classification – synthetic and natural, organic and inorganic, thermoplastic and thermosetting. Plastics, elastomers, fibres and liquid resins. Techniques of polymerization Bulk, solution, emulsion and suspension polymerization

UNIT - II Kinetics of polymerization

Kinetics of condensation and addition polymerisation; ionic, free radical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers.

Characterisation of polymers-Appearance, feel and hardness, density, effect of heat, solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state.

UNIT - III Molecular Weight and Properties of Polymers

Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry –Thermal properties of polymers – Glass Transition Temperature-, Factors Influencing Glass Transition Temperature, and its Importance. Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity

12

UNIT - IV Polymer technology

Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each)

Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer

Processing of polymers – casting, thermoforming, moulding – extrusion, compression, blow moulding – foaming, lamination, reinforcing – processing of fibres – melt, wet and dry spinning.

UNIT - V Speciality polymers & Polymer Degradation

Speciality polymers Polyelectrolytes, conducting polymers, biomedical polymers, liquid crystalline polymers, electroluminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanisation of rubber. Polymer Degradation Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.

BOOKS FOR STUDY:

- Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer Science, New Delhi: New Age International, 2015
- Misra G.S. Introductory Polymer Chemistry. New Delhi: Wiley Eastern, 2010.
- Ahluwalia, V.K. Anuradha Mishra, Polymer Science A Text Book, Ane Books India: New Delhi, 2008.

BOOKS FOR REFERENCES:

- > Billmeyer, F.W. Polymer Science. India: Wiley-Interscience, 2007.
- Seymour, R. B.; CarraherJr.C.E. Polymer Chemistry: An Introduction, Marcel Dckker Inc : New York, 1981.
- > Sinha, R. Outlines of Polymer Technology, Prentice Hall of India: New Delhi, 2000.

WEB RESOURCES:

- https://polymerdatabase.com
- http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1
- http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weigh ts+of+polymers.pdf

60

Total Lecture Hours

Nature of Course	EMPLC)YABII	LITY	\checkmark	SKILL OR	IENTED		ENTRE	ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGI	ONAL	· 🗸	NATION	AL		GLOBAL		
Changes Made in the Course	Percentag	e of Ch	lange		No Char	nges Made			New Course		
									0 (1		

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

COURS	SE OUTC	OMES:							K	LEVEL		
After s	tudying	this cour	se, the	students	s will be	able to:						
CO1	explain cla	assification	of polyme	ers, elaston	ners, fibres	and liquid	resins		K	1 to K4		
CO2	explain ad	dition and	condensati	on polyme	rization, m	echanical	properties	of polyme	ers K	1 to K4		
CO3	determine polymers	the molecu	lar weight	of polyme	ers, and exp	lain the th	ermal prop	perties of	K	1 to K4		
CO4	explain re	actions of p	olymers a	nd polyme	r processin	g			K	1 to K4		
CO5	discuss sp	eciality pol	ymers like	PVC, PM	MA, rubbe	rs, biodegi	adable pol	ymers	K	1 to K4		
MAPPING WITH PROGRAM OUTCOMES:												
CO/PO	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO											
CO1	S	S	S	S	S	S	S	Μ	S	Μ		
CO2	М	S	S	S	Μ	S	S	Μ	Μ	Μ		
CO3	S	S	S	Μ	S	S	S	Μ	S	M		
CO4	S	S	S	S	S	S	S	Μ	Μ	M		
CO 5	S	Μ	S	S	S	S	S	Μ	Μ	S		
	S- STROI	NG			M – MED	IUM			L - LO	W		
CO / F	O MAPP	ING:										
C	os	PSO1]	PSO2	PSC	03	PSO4	ŀ	PSC	5		
C	01	3		3	3		3		3			
C	02	3		3	3		3		3			
C	03	3		3	3		3		3			
C	04	3		3	3		3		3			
C	05	3		3	3		3		3			
Weig	ghtage 15 15 15 15								15	5		
Weig percer Co Contr to	ghted 1tage of urse ibution POs	3.0		3.0	3.0	D	3.0		3.()		

LESSC	ON PLAN:		
UNIT	Polymer Science	HRS	PEDAGOGY
I	Difference between polymer and macromolecule – classification – synthetic and natural, organic and inorganic, thermoplastic and thermosetting.	6	Chalk & talk, PPT
	Plastics, elastomers, fibres and liquid resins. Techniques of polymerization Bulk, solution, emulsion and suspension polymerization	6	Chalk & talk, PPT
	Kinetics of condensation and addition polymerisation; ionic, free radical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers.	6	Chalk & talk, PPT
11	Characterisation of polymers-Appearance, feel and hardness, density, effect of heat, solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state.	6	Chalk & talk, PPT
	Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot	6	Chalk & talk, PPT
III	ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry –Thermal properties of polymers – Glass Transition Temperature-, Factors Influencing Glass Transition Temperature, and its Importance. Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity	6	Chalk & talk, PPT
	Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each)	6	Chalk & talk, PPT
IV	Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer Processing of polymers – casting, thermoforming, moulding – extrusion, compression, blow moulding – foaming, lamination, reinforcing – processing of fibres – melt, wet and dry spinning.	6	Chalk & talk, PPT
77	Speciality polymers Polyelectrolytes, conducting polymers, biomedical polymers, liquid crystalline polymers, electroluminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanisation of rubber.	6	Chalk & talk, PPT, semianr
v	Polymer Degradation Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.	6	Chalk & talk, PPT, seminar

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

		Dis	tribution of	Marks with	K Level	CIA I & CIA I	I	
	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 %	
	K1	2	-	-	2	3.57	25	
СТА	K2	2	10	-	12	21.43		
	K3	-	10	10 16 26 46.43		46.43	46.43	
I	K4	-	-	16	16	28.57	28.57	
-	Marks	4	20	32	56	100	100	
	K1	2	-	-	2	3.57	25	
	K2	2	10	-	12	21.43		
CIA II	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.

Summati	ive Exam	ination – B	lue Print Artic	culation Map	ping – K Level with Co	ourse Outcomes (COs)	
			Section A	(MCQs)	Section B (Either / or	Section C (Either / or	
S. No	COs	K - Level	No. of	K – Level	Choice) With	Choice) With	
			Questions		K - LEVEL	K - LEVEL	
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)	
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)	
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)	
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)	
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)	
No. of Q	uestions to	be Asked	10		10	10	
No. of Que	estions to l	be answered	10		5	5	
Marks for each question			1		5	8	
Total Marks for each section			10		25	40	
	(Fig	ires in parent	thesis denotes, o	questions show	ild be asked with the give	en K level)	

	Distribution of Marks with K Level											
K Level	Section A (Multiple Choice Questions)	Section B (Either or ChoiceSection C (Either/ or Choice)Tot Mar		Total Marks	% of (Marks without choice)	Consolidated %						
K1	5	-	-	5	3.57	21.43						
K2	5	20	-	25	17.86	20						
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.												

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

Summative Examinations - Question Paper – Format

Answer A	LL the que	stions		PART – B	(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K2		
			<u>.</u>	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 AL	L the question	ons		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									

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Pharmaceutical Chemistry							
Course Code	23UCHEC64	L	Р	С				
Category	Elective	4	-	3				
COURSE OBJECTIVES:								

The course aims at providing an overall view of

- > drugs design and drug metabolism
- > important Indian medicinal plants, common diseases and antibiotics
- > drugs for major diseases like cancer, diabetes and AIDS
- > analgesics and antipyretic agents
- significance of clinical tests

UNIT - I Introduction

Sources of drugs – dosage forms – bio availability – routes of administration – absorption, distribution and elimination of drugs – drug metabolism – prescription terms.

Structure and pharmacological activity: Effect of – unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups.

Development of Drugs:

Development of a drug – classic steps- lead compounds- comparison of traditional and modern methods of development of drugs – drug design by method of variation – disjunction and conjunction methods.

UNIT - II Common diseases and their treatment

Causes, prevention and treatment of the following diseases: Insect borne diseases– malaria, filariasis, plague; Air borne diseases– diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases – cholera, typhoid, dysentery. Digestive system – jaundice; Respiratory system – asthma; Nervous system – epilepsy.

Antibiotics

Definition – classification – structure and therapeutic uses of chloramphenicol, penicillins, structure activity relationship of chloramphenicol; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.

UNIT - III Drugs for major diseases

Cancer – common causes – chemotherapy – anti neoplastic agents - classification –adverse effects of cytotoxic agents ; alkylating agents – chlorambucil ; anti metabolites – methotrexate, fluouracil ; Vinca alkaloids – vincristine, vinblastine.Diabetes– types –management of diabetes – insulin ; oral hypoglycemic agents - sulphonyl ureas – chlorpropamide ; biguanides - metformin – thiazolidinediones .Cardiovascular drugs– cardio glycosides ; anti arrhythmic agents – quinidine, propranolol hydrochloride ; anti-hypertensive drugs - Aldomet, pentoliniumtartarate; vasodilator- tolazoline hydrochloride, sodium nitroprusside.AIDS – causes, symptoms and prevention – anti HIV drugs - AZT, DDC.

12

12

UNIT - IV General Drugs

12

Analgesics and antipyretic agents Classification – action of analgesics – narcotic analgesics – morphine; synthetic analgesics – pethidine, methadone; antipyretic analgesics – salicylic acid derivatives, derivatives. Anaesthetics Definition, characteristics, classification - general anaesthetics – volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene– storage, advantages and disadvantages ; non volatileanaesthetics – thiopental sodium ; local anaesthetics – requisites – advantages-esters – cocaine, benzocaine ; amides – lignocaine, cinchocaine.

UNIT - V Clinical Chemistry

Clinical Chemistry Blood tests – blood count – complete haemotogram – Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time – glucose tolerance test.

Significance of Clinical Tests Serum electrolytes - blood Glucose - orthotoluidine method; Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile – cholesterol, triglycerides, HDL, LDL, coronary risk index. Urine examination – pH, tests for glucose, albumin and bile pigment.

Total Lecture Hours

60

12

BOOKS FOR STUDY:

- Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S.Chand& company, New Delhi.
- Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultan chand& sons, Delhi.
- Tripathi K D, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi.

BOOKS FOR REFERENCES:

- Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6thed., Himalaya publishing house, Bombay.
- Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II)., Himalaya publishing house, Bombay.
- > Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi.

WEB RESOURCES:

- https://onlinecourses.nptel.ac.in/noc20_cy16/preview
- https://onlinecourses.swayam2.ac.in/cec20_lb05/preview

Nature of Course	EMPLC)YABII	JTY	~	SKILL OR		2			
Curriculum Relevance	LOCAL REGIONAL NATIONAL 🖌 GLOBAL									
Changes Made in the Course	Percentag	e of Ch	ange		No Chan	iges Made			New Course	\checkmark
* Treat 2	20% as eac	h unit	(20*5=1	00%)	and calcula	ate the nerce	ntage	of char	nge for the cou	irse.

COURS	SE OUTC	OMES:								K I	LEVEL		
After s	tudying	this cou	rse, the	students	s will be	able to:							
CO1	Define the activity, of treatment of	e pharmac lrug devel of diseases	eutical ter opment, ; list the ty	rminologies clinical ch pes of IPR	s; describe emistry, h and traden	the princ nematology narks.	ciples in p 7, theraped	harmacolo atic drugs	ogical s and	K1	to K4		
CO2	Discuss the properties factors for	ne develop of therap patentabili	ment of c eutic agen ity.	lrugs, struc nts, signifi	ctural active cance of 1	vity, diseas medicinal	se types, p plants, cli	hysio-che nical test	emical s and	K1	to K4		
CO3	Apply the principles involved in structural activity and drug designing, functions of haematological agents; estimation of clinical parameters and therapeutic application of K1 to K4 drugs for major diseases.												
CO4	explain classification of analgesics and anasthetics, and physiological functions of plasma protiens K1 to K4												
CO5	explain the significance of clinical tests like blood urea, serum proteins and coronary risk index												
MAPPING WITH PROGRAM OUTCOMES:													
CO/PC	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	РО	9	PO10		
CO1	S	S	S	S	S	S	S	Μ	S		M		
CO2	Μ	S	S	S	Μ	S	S	Μ	M		Μ		
CO3	S	S	S	Μ	S	S	S	Μ	S		Μ		
CO4	S	S	S	S	S	S	S	Μ	M		Μ		
CO5	S	М	S	S	S	S	S	Μ	Μ		S		
	S- STRON	IG			M – MEC	IUM			L - L	OW	7		
CO / P	O MAPPI	NG:											
C	os	PSO1		PSO2	PSC	03	PSO4	-	P	SO5	5		
C	01	3		3	3		3			3			
С	02	3		3	3		3		3				
С	03	3		3	3		3			3			
C	04	3		3	3		3			3			
C	05	3		3	3		3			3			
Weig	htage	15		15	1	5	15			15			
Weig percer Cor Contr t PS	ghted Itage of Irse ibution SOs	3.0		3.0	3.	0	3.0		3.0				

LESSC	ON PLAN:		
UNIT	Pharmaceutical Chemistry	HRS	PEDAGOGY
I	Sources of drugs – dosage forms – bio availability – routes of administration – absorption, distribution and elimination of drugs – drug metabolism – prescription terms. Structure and pharmacological activity: Effect of – unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups.	6	Chalk & talk, PPT
	Development of Drugs: Development of a drug – classic steps- lead compounds- comparison of traditional and modern methods of development of drugs – drug design by method of variation – disjunction and conjunction methods.	6	Chalk & talk, PPT
II	Causes, prevention and treatment of the following diseases: Insect borne diseases– malaria, filariasis, plague; Air borne diseases– diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases – cholera, typhoid , dysentery. Digestive system – jaundice; Respiratory system – asthma; Nervous system – epilepsy.	6	Chalk & talk, PPT
	Antibiotics Definition – classification – structure and therapeutic uses of chloramphenicol, penicillins, structure activity relationship of chloramphenicol; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.	6	Chalk & talk, PPT
	Cancer – common causes – chemotherapy – anti neoplastic agents - classification –adverse effects of cytotoxic agents ; alkylating agents – chlorambucil ; anti metabolites – methotrexate, fluouracil ; Vinca alkaloids – vincristine, vinblastine.Diabetes– types –management of diabetes – insulin	6	Chalk & talk, PPT
III	oral hypoglycemic agents - sulphonyl ureas – chlorpropamide ; biguanides - metformin – thiazolidinediones .Cardiovascular drugs– cardio glycosides ; anti arrhythmic agents – quinidine, propranolol hydrochloride ; anti- hypertensive drugs - Aldomet, pentoliniumtartarate; vasodilator- tolazoline hydrochloride, sodium nitroprusside.AIDS – causes, symptoms and prevention – anti HIV drugs - AZT, DDC.	6	Chalk & talk, PPT
	Analgesics and antipyretic agents Classification – action of analgesics – narcotic analgesics –morphine; synthetic analgesics – pethidine, methadone; antipyretic analgesics – salicylic acid derivatives, derivatives.	6	Chalk & talk, PPT
IV	Anaesthetics Definition, characteristics, classification - general anaesthetics – volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene– storage, advantages and disadvantages ; non volatileanaesthetics – thiopental sodium ; local anaesthetics – requisites – advantages- esters – cocaine, benzocaine ; amides – lignocaine, cinchocaine ,	6	Chalk & talk, PPT
v	Clinical Chemistry Blood tests – blood count – complete haemotogram – Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time – glucose tolerance test. Significance of Clinical Tests Serum electrolytes - blood Glucose - orthotoluidine method;	6	Chalk & talk, PPT, seminar
	Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile – cholesterol, triglycerides, HDL, LDL, coronary risk index. Urine examination – pH, tests for glucose, albumin and bile pigment.	6	Chalk & talk, PPT, seminar

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

Distribution of Marks with K Level CIA I & CIA II								
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %	
	K1	2	-	-	2	3.57	25	
	K2	2	10	-	12	21.43		
CIA	K3	-	10	16	26	46.43	46.43	
Ι	K4	-	-	16	16	28.57	28.57	
	Marks	4	20	32	56	100	100	
	K1	2	-	-	2	3.57	25	
CIA	K2	2	10	-	12	21.43		
	K3	-	10	16	26	46.43	46.43	
11	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

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)							
	COs	K - Level	Section A	(MCQs)	Section B (Either / or	Section C (Either / or	
S. No			No. of	K Lovel	Choice) With	Choice) With	
			Questions	K – Level	K - LEVEL	K - LEVEL	
1	CO1	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)	
2	CO2	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)	
3	CO3	K1-K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)	
4	CO4	K1-K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)	
5	CO5	K1-K4	2	K1&K2	2 (K4,K4)	2 (K3,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)							

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

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	20
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.						
Q. No.	Unit	CO	K-level			
----------	-------------	------------	---------	----------	---------------------	
Answer A	ALL the que	stions		PART – A	(10 x 1 = 10 Marks)	
	Unit - I	CO1	K1			
1.				a)	b)	
				c)	d)	
	Unit - I	CO1	K2			
2.				a)	b)	
				c)	d)	
	Unit - II	CO2	K1			
3.				a)	b)	
				c)	d)	
	Unit - II	CO2	K2			
4.				a)	b)	
				c)	d)	
	Unit - III	CO3	K1			
5.				a)	b)	
				c)	d)	
	Unit - III	CO3	K2			
6.				a)	b)	
				c)	d)	
	Unit - IV	CO4	K1			
7.				a)	b)	
				c)	d)	
	Unit - IV	CO4	K2			
8.				a)	b)	
				c)	d)	
	Unit - V	CO5	K1			
9.				a)	b)	
				c)	d)	
	Unit - V	CO5	K2			
10.				a)	b)	
				c)	d)	

Summative Examinations - Question Paper – Format

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 AL	L the question	ons		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						

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



DEPARTMENT OF CHEMISTRY

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

A N								
Course Name	Professional Competency Skill - Employability Readiness							
Course Code	23UCHSP51 L	Р	С					
Category Skill - 3								
COURSE OBJE	CTIVES: convert to a practical paper							
This course aim	s at providing							
 Visualisation Hands on tr Identify the To Optimiz To identify 	n of the protein structure and other chemical structures in advanced softwa aining of structure drawing and prediction of NMR spectrum in Chem draw bond length, bond angles and UV-Visible spectrum using molecular mode e, calculate the band gap and find IR spectrum of benzene using Gaussian. the binding constant and binding sites of the drugs in enzymes	re. v. lling.						
Experiments:								
 Visualisation and 5D representations of proteins using advanced visualization software with VMD/ Rasmol/ Molegro molecular viewer/ Phython molecular Viewer/ Avogadro. Draw the structure of the given compound and generate the 1H and 13C NMR spectrum of the compound using Chemdraw and compare with its original spectra (original spectrum will be given by us). Identify the Bond length and bond angles between the atoms in the anthracene by molecular modelling using Chem 3D. Identify the UV-Vis spectrum Spectrum of Benzene using Chem 3D. Optimize and calculate the HOMO, LUMO band gap value of Benzene using Gaussian view. Find the IR spectrum of Benzene using Gaussian View. Identify the binding constant and binding site of the aspirin in cyclooxygenase using Autodock 								
			45					
 BOOKS FOR R Andrew R.I Fenniri, H. Lednicer, D Internationa Gordon, E.I (1000) Will 	EFERENCES: Leach Molecular Modelling Principles and applications . (2001) II ed . Pren "Combinatorial Chemistry – A practical approach",(2000) Oxford University . "Strategies for Organic Drug Discovery Synthesis and Design"; (1998) W il Publishers. M. and Kerwin, J.F "Combinatorial chemistry and molecular diversity in dr	itice Ha ity Press Viley ug disco	ll. s, UK. overy"					

Nature of Course	EMPLOYABILITY			~	SKILL OR		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGI	ONAL		NATION	AL	\checkmark	GLOBAL	
Changes Made in the Course	Percentage of Change				No Chan	ges Made			New Course	✓
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course										

and calculate the percentage of change for the course. eat 20% as each unit (20 100 70)

COURS	SE OUTCOMES:									LEVEL
After s	tudying	this cou	rse, th	e students	s will be	able to:				
CO1	visualise t	he protein s	structure	in advanced	software				K	1 to K4
CO2	draw and p	predict NM	R spectr	um in chem	draw				K	1 to K4
CO3	Identify bo	ond length,	bond an	gles using m	olecular m	odelling			K	1 to K4
CO4	Calculate the band gap and find IR spectrum of benzene using Gaussian									
CO5	Identify th	e binding c	constant	and binding	sites of the	drugs in e	enzymes		K	1 to K4
MAPPI	NG WITH	I PROGR	AM OU	TCOMES						
CO/PC	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	Μ	S	Μ
CO2	M	S	S	S	M	S	S	Μ	M	Μ
CO3	S	S	S	Μ	S	S	S	Μ	S	Μ
CO4	S	S	S	S	S	S	S	Μ	M	Μ
CO5	S	M	S	S	S	S	S	Μ	Μ	S
5	S- STRON	IG			M – MEI	IUM			L - LO	V
CO / P	O MAPPI	NG:								
C	os	PSO1		PSO2	PSC	03	PSO ₂	1	PSO	5
C	01	3		3	3 3		3		3	
C	02	3		3	3 3		3		3	
C	03	3		3	3		3		3	
C	04	3		3	3	;	3		3	
C	CO5 3		3	3	;	3		3		
Weig	eightage 15 15				15 15				15	
Weighted percentage of Course Contribution to PSOs		3.0		3.0	3.	0	3.0		3.0	

	Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)							
Internal	COs	K Level	Section					
	CO1	K1 – K4	1 (K4)					
	CO2	K1 – K4	1 (K4)					
Model	CO3	K1 – K4	1 (K3)					
Exam	CO4	K1 – K4	1 (K4)					
	CO5	K1- K4	1 (K4)					
Question Pattern		No. of Questions to be asked	5					
		No. of Questions to be answered	5					
Mo	del exam	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 qu	estions		(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 Quest	ions to be Asked	5			
	No. of Questic	5				
	Marks for	Marks for each question 12				
	Total Marks	60				
(Figures in parenthesis denotes, questions should be asked with the given K level)						

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

*Student will not be allowed to do the Summative practical exam if record notebook is not validated by the internal examiner.

Summative Examinations - Question Paper – Format

Answei	ALL the qu	uestions		(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	

15 marks to be awarded for proper record submission.