SRI SARADA COLLEGE FOR WOMEN(AUTONOMOUS) SALEM -16 Reaccredited with 'B++' Grade by NAAC Affiliated to Periyar University



PG & RESEARCH DEPARTMENT OF CHEMISTRY

OUTCOME BASED SYLLABUS

B.Sc. CHEMISTRY

(For the students admitted in 2023 – 24)

PROGRAMME OUTCOMES (PO) OF B.Sc. DEGREE PROGRAMME IN CHEMISTRY							
Programme	B.Sc.						
Programme Code							
Duration	3 Years for UG						
Program (Pos)	 PO1 : Disciplinary Knowledge have firm subject knowledge required for higher studies, professional and applied courses. PO2 : Problem Solving Skill apply basic practical skills & technical knowledge along with domain knowledge of different subjects in the science & humanities stream. PO3 : Critical Thinking/ Analytical Reasoning develop scientific aptitude Integrate skills of analysis, critiquing, application and creativity. PO4 : Digital literacy main distribute technical technices in emphasized detected 						
	 employ appropriate digital tools and techniques in analysing data and creative design. PO5 : Employment/ Entrepreneurship Skill gain competence to pursue higher learning, research and to opt for job opportunities or entrepreneurship. PO6 : Leadership Quality interact effectively with others displaying leadership and team spirit. PO7 : Contribution to Society demonstrate responsibility as citizens for national development through community outreach, wellness of self and a sustainable environment. PO8 : Research and Development inculcate creativity in academics and research PO9 : Self directed learning apply digital tools to collect, analyse and interpret data and present scientific findings. PO10: Life long Learning Exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community. 						
Programme Specific Outcome (PSOs)	 PSO1- Disciplinary Knowledge Gain in-depth knowledge of the fundamental concepts in all disciplines of chemistry. PSO2 – Scientific Reasoning Capability to integrate the basics of chemistry and advanced topics and analytical. Skills in organic, inorganic and physical chemistry. PSO3 – Multicultural Competence Imbibe leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities. PS04 – Professional Ethics/ Entrepreneurship Skill Apply the concepts of chemistry to solve problems in the community, entrepreneurial and research pursuits. PS05 – Self Directed Learning Gain competence to pursue higher education and career opportunities in chemistry and allied fields. 						

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS) SALEM-16 PG & RESEARCH DEPARTMENT OF CHEMISTRY B.Sc. CHEMISTRY PROGRAMME STRUCTURE UNDER CBCS (From the academic year 2023-24 onwards) Total Credits: 140 + Extra Credits (Maximum 28)

FIRST YEAR

SEMESTER - I

Part	Course	Course Title	Code	No. of Hours	Credit				
Ι	Language	Tamil -I Hindi-I Sanskrit-I	23ULTC1 23ULHC1 23ULSC1	6	3				
II	English	English-I	23ULEC1	6	3				
	Core Course -I	General Chemistry-I	23UCHCC1	5	5				
III	Core Course -II	Core Practical- I: Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations	23UCHCCQ1	4	3				
	Elective – I (GE)	Theory of Equations and Differential Calculus	23UCHGEC1	5	5				
	Skill Enhancement Course-I (NME)	kill Enhancement Course-I (NME) Food Chemistry 23UCH		2	2				
IV	Skill Enhancement Foundation Course	Foundation Chemistry	23UCHSEFC	2	2				
	,	Total		30	23				
V	Articulation arPhysical Fitnes	nd Idea Fixation Skills ss Practice – 35 hours per ser	mester						
	Advanced Diploma Course in Applied Chemistry Level- 1: Certificate Course 100 hours per year								

SEMESTER - II

Part	Course	Course Title	Code	No. of Hours	Credit			
Ι	Language	Tamil -II Hindi-II Sanskrit-II	23ULTC2 23ULHC2 23ULSC2	6	3			
II	English	English-II	23ULEC2	6	3			
	Core Course -III	General Chemistry-II	23UCHCC2	5	5			
III	Core Course -IV	Core Practical- II: Qualitative Organic Analysis and Preparation of Organic Compounds	23UCHCCQ2	4	3			
		Integral Calculus and Laplace Transform	23UCHGEC2	3	3			
	(GE)	GE) Theory of Equations and laplace Transform using sage Math-Practical 23UCHMGI CQ		2	2			
	Skill Enhancement Course-II (NME)	Dairy Chemistry	23UCHSEC2	2	2			
IV	Skill Enhancement Course-III (Indian Knowledge System)	Inherited Knowledge in Cosmetic Chemistry	23UCHSEC3	2	2			
		Total		30	23			
	 Articulation and Idea Fixation Skills Physical Fitness Practice – 35 hours per semester Certificate Course in Yoga – 30 hours – 1 Extra Credit 							
V	 Advanced Diploma in Applied Chemistry Level -1: Certificate Course 100 hours per year-2 Extra Credits Extra credits are given for extra skills and courses qualified in MOOC/NPTEL 							

SECOND YEAR

III SEMESTER

Part	Cour	se	Course Title	Code	Hours per week (L/T/P)	Credits		
			Tamil-III	23ULTC3				
Ι	Language		Hindi-III	23ULHC3	6	3		
			Sanskrit-III	23ULSC3				
II	English		English – III	23ULEC3	6	3		
	Core Cours	e- V	General Chemistry- III	23UCHCC3	5	5		
III	Core Course -VI		ourse -VI Core Practical- III Qualitative Inorganic 23UCHCCQ3 Analysis		4	3		
	Elective -III (GE)		Physics-I	23UCHGEC3	3	3		
			Physics Practical-I	23UCHGECQ1	2	2		
	Skill Enhancement Course -IV		Entrepreneurial Skills in Chemistry (Entrepreneurial Skill)	23UCHSEC4	1	1		
IV	Skill Enhancement Course -V		Pesticide Chemistry	23UCHSEC5	2	2		
	EVS		Environmental Studies	23UEVSC	1	-		
	Total 30							
		Articulation and Idea Fixation skills						
		Physical Fitness Practice – 35 hours per Semester						
v	Advanced Diploma in Applied Chemistry Level -2: Diploma Course 100 hours per year							
		Extra credits are given for extra skills and courses qualified in MOOC/NPTEL						

SEMESTER -IV

Part	Course		Course Course Title Code		Hours per week (L/T/P)	Credits			
			Tamil-IV	23ULTC4					
Ι	Language		Hindi-IV	23ULHC4	6	3			
			Sanskrit-IV	23ULSC4					
II	English		English – IV	23ULEC4	6	3			
	Core Cours	e- VII	General Chemistry- IV	23UCHCC4	5	5			
III	Core Course -VIII		Physical Chemistry Practical- I	23UCHCCQ4	3	3			
	Elective -IV	/ (GE)	Physics-II	23UCHGEC4	3	3			
			Physics Practical-II	23UCHGECQ2	2	2			
	Skill Enhancement Course -VI		Instrumental methods of Chemical Analysis	23UCHSEC6	2	2			
IV	Skill Enhancement Course -VII		Forensic Science	23UCHSEC7	2	2			
	EVS		Environmental Studies	23UEVSC	1	2			
		Total 30							
		Articulation and Idea Fixation skills							
		Physical Fitness Practice – 35 hours per Semester							
v		Advanced Diploma in Applied Chemistry Level -2: Diploma Course 100 hours per year							
		Extra credits are given for extra skills and courses qualified in MOOC/NPTEL							

*Internship/Field visit/ Industrial visit will be carried out during the summer vacation of the second year and 2 credits will be included in the Fifth Semester Mark Statement.

Title of the Course		GEN	NERA	L CHEM	ISTR	Y-I		
Course No.			Core Course – I					
Category	Com	Year	Ι	Cara ll'Ar	_	Course		
	Core	Semester	Ι	Credits	2	С	ode	230CHCC1
Instructional	Lecture	Tutoria	al	Lab P	ractio	ce		Total
hours per week	4	1			-			5
Prerequisites		Higl	ner see	condary cl	hemis	stry		
Objectives of the course	The course a various wave pa periodic explaini nature c chemist	 The course aims at giving an overall view of the various atomic models and atomic structure wave particle duality of matter periodic table, periodicity in properties and its application in explaining the chemical behaviour nature of chemical bonding, and fundamental concepts of organic 						
Course Outline	UNIT-I Atomic stru History of a Atomic num quantum the Interpretation nature of experiment H of Atoms an principle; Nu	UNIT-I15 HoursAtomic structure and Periodic trendsHistory of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- de Broglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli's exclusion principle and Aufbau principle; Numerical problems involving the core concepts.						
	UNIT-II15 HoursIntroduction to Quantum mechanicsClassical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wavefunctions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals - Probability density and significance of Ψ and Ψ^2 .Modern Periodic Table Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity- electronegativity scales, applications of electronegativity. Problems involving the core concepts							

15 Hours

UNIT-III

Structure and bonding - I

Ionic bond Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarisation – polarising power and polarizability; Fajan's rules - effects of polarisation on properties of compounds; problems involving the core concepts.

Covalent bond Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB₂, AB₃, AB₄, AB₅, AB₆ and AB₇

Partial ionic character of covalent bond-dipole moment, application to molecules of the type A₂, AB, AB₂, AB₃, AB₄; percentage ionic character numerical problems based on calculation of percentage ionic character.

UNIT-IV

15 Hours

15 Hours

Structure and bonding - II

VB theory – application to hydrogen molecule; concept of resonance resonance structures of some inorganic species – CO_2 , NO_2 , $CO_3^{2^-}$, NO_3^{-1} ; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H₂, C₂, O₂, O_{2⁺}, O_{2⁻}, O_{2²⁻}, N₂, NO, HF, CO; magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of BF₃, NH₃, NH_{4⁺}, H₃O⁺ properties Metallic bond-electron sea model, VB model; Band theorymechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points.

UNIT-V

Basic concepts in Organic Chemistry and Electronic effects

Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrenes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects.

Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance. Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane Types of organic reactions- addition, substitution, elimination and rearrangements

Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved. (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text Reference Books	 1. 1. Madan, R. D. and Sathya Prakash, Modern Inorganic Chemistry, S. Chand and Company: New Delhi, 2nd Ed., 2003. 2. Rao, C.N. R. University General Chemistry, Macmillan Publication: New Delhi, 2000. 3. Puri, B. R. and Sharma, L. R. Principles of Physical Chemistry, Vishal Publishing Company: Jalandhar, 38th Ed., 2002. 4. Bruce, P. Y. and Prasad K. J. R. Essential Organic Chemistry, Pearson Education: New Delhi, 2008. 5. Dash U.N, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi,2016 1. Maron, S. H. and Prutton C. P. Principles of Physical Chemistry, The Macmillan Company: Newyork, 4thEd.,1972.
DUUKS	 Lee, J. D. Concise Inorganic Chemistry, ELBS William Heinemann: London, 4th Ed.,1991. Gurudeep Raj, Advanced Inorganic Chemistry, Goel Publishing House: Meerut, 26thEd., 2001. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford University Press:New York, 10th Ed., 2014. Huheey, J. E. Inorganic Chemistry: Principles of Structure and Reactivity, Addison, Wesley Publishing Company: India, 4th Ed., 1993
Website and e-learning source	 <u>https://onlinecourses.nptel.ac.in</u> <u>https://www.mikeblaber.org/oldwine/chm1045/notes_m.htm</u> <u>http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html</u> <u>https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding</u> <u>https://www.chemtube3d.com/</u>

Course Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1**: explain the atomic structure, wave particle duality of matter, periodic properties, bonding, and properties of compounds.
- **CO2**: classify the elements in the periodic table, types of bonds, reaction intermediates, electronic effects in organic compounds and types of reagents.
- **CO3**: apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, electronegativity, percentage ionic character and bond order.
- **CO4**: evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions, structure, reactivity and electronic effects
- **CO5**: construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H bonding and organic reaction mechanisms.

PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 CO1 S S S Μ Μ Μ L S L S S **CO 2** S S Μ Μ S Μ Μ Μ S **CO 3** S S S S S S S Μ Μ Μ **CO 4** S S S S Μ S Μ S S S **CO 5** S S S S S S S S Μ S

CO-PO mapping (Course Articulation matrix)

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	2	3	3
CO2	3	3	2	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	13	15	15
Weighted percentage of Course Contribution to PSO	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

Title of the	QUANTITATIVE INORGANIC ESTIMATION (TITRIMETRY)								
Course	AND INORGANIC PREPARATIONS								
Course No.	Core Course-II: Core Practical-I						Γ		
Category	Core	Year Semester	I	Credits	3	C	ourse Code	23UCHCCQ1	
Instructional	Lecture	Tuto		Lah P	racti	Ce		Total	
hours per week	1		141		3			4	
Proroquisitos	Higher Secon	dary Chemi	otry	•	,				
Trerequisites	Tingher Secon		Suly						
Objectives of	This course a	ims at provi	ding k	nowledge	on				
the course	• labora	tory safety							
	handli Ouent	ing glasswai	res						
	• Quant	ration of ind	ation	c compour	nde				
Course Outline	UNIT I		Jigam	e compour	ius			10 Hours	
	Chemical La	boratory S	afety	in Acaden	nic I	nstit	utions		
	Introduction	- importan	ice of	safety e	educa	ation	for s	tudents, common	
	laboratory ha	zards, asses	sment	and minin	nizat	ion	of the r	isk of the hazards,	
	prepare for e	emergencies	from	uncontro	lled	haza	ards; co	oncept of MSDS;	
	importance ai	nd care of PI	PE; pro	oper use an		erati	on of cl	fire extinguishers	
	demonstration	n of operation	on: che	emical was	ste ar	nd sa	fe dispo	osal	
	Common Ap	Common Apparatus Used in Quantitative Estimation (Volumetric)							
	Description a	nd use of b	urette,	pipette, st	tanda	ard f	lask, m	easuring cylinder,	
	conical flask,	beaker, funi	nel, dr	opper, clan	np, s	tand	, wash t	oottle, watch glass,	
	wire gauge ar	nd tripod sta	nd.				•		
	Principle of	Quantitativ	e Esti	mation (V	olur	netr	ic)	anidining agant.	
	Equivalent w	eight of an	acia,	base, sait,	, rea	ucin _.	g agent	, oxidizing agent;	
	standards, pr	eparation of	stanc	lard soluti	ons:	thea	prines of	acid-base, redox	
	complexomet	ric, iodime	tric ar	id iodome	tric	titra	tions; in	ndicators – types,	
	theory of aci	d-base, redo	ox, me	etal ion an	d ad	sorp	tion inc	licators, choice of	
	indicators.								
	UNIT II 25 Hours							25 Hours	
	Quantitative	Estimation	n (Voli alution	umetric)	from	oto	ale colut	ion	
	Preparation 0	Preparation of standard solution, dilution from stock solution							
	Estimation of sodium oxalate using standard ferrous ammonium sulphate								
	Dichrometry								
	Estimation of	f ferric alui	n usii	ng standar	d di	chro	mate (e	external indicator)	
	Estimation of	Estimation of ferric alum using standard dichromate (internal indicator)							
	Fetimation of	conner in a	onner	sulphoto u	sina	cton	dard di	chromate	
	Argentimetr	v (Demonst	ratio	i Exnerim	ent)	stall	uaru ul	unomate	
	Estimation of	f chloride in	bariu	m chlorid	e usi	ng s	tandard	sodium chloride/	
	Estimation of	chloride in	sodiu	m chloride	(Vo	lhar	d's metl	hod)	
1	1								

	UNIT III 25 Hours					
	Complexometry					
	Estimation of hardness of water using EDTA					
	Estimations					
	Estimation of iron in iron tablets					
	Estimation of ascorbic acid.					
	Preparation of Inorganic compounds					
	Potash alum					
	Tetraammine copper (II) sulphate					
	Hexamminecobalt (III) chloride					
	Mohr's Salt					
Skills acquired	Knowledge, Problem solving, Analytical ability, Professional Competency,					
from this course	Professional Communication and Transferable skills.					
Recommended	1. Venkateswaran, V, Veeraswamy, R. & Kulandivelu, A.R. <i>Basic</i>					
Text	Principles of Practical Chemistry, Sultan Chand & Sons: New					
	Delhi, 2 nd Ed.,1997.					
	2. Nad, A. K, Mahapatra, B.& Ghoshal, A, An advanced course in					
	Practical Chemistry, New Central Book Agency: Kolkata, 3rd Ed., 2007.					
Reference	1.Mendham, J, Denney, R. C, Barnes, J. D, Thomas, M, Sivasankar, B,					
Books	Vogel's Textbook of Quantitative Chemical Analysis, 6th Ed., Pearson					
	Education Ltd: New Delhi, 2000.					
Website and	1)http://www.federica.unina.it/agraria/analytical-					
e-learning	chemistry/volumetricanalysis					
source	2)https://chemdictionary.org/titration-indicator/					
Course outcome	s (For mapping with POs and PSOs)					
On successful co	mpletion of the course the students should be able to					
CO1: explain the	e basic principles involved in titrimetric analysis and inorganic preparations.					
CO2: compare the methodologies of different titrimetric analysis.						
CO3: calculate th	CO3: calculate the concentrations of unknown solutions in different ways and develop the skill					
to estimate	to estimate the amount of a substance present in a given solution.					
CO4: assess the y	yield of different inorganic preparations and identify the end point of various					
titrations.						

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	Μ	М	S	S	М	L	Μ	S	Μ
CO 2	М	S	S	S	М	S	S	Μ	М	М
CO 3	S	S	S	М	S	S	S	М	S	М
CO 4	S	S	S	S	S	S	S	Μ	Μ	М

Level of Correlation between F	PSO's and CO's
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CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

Title of th	ne Course	Theory of Equations and Differential Calculus								
		(I B.Sc. Che	mist	ry)						
Course N	0.	Elective – I	(GE)						
Category	ELECTIVE	TIVE Year I Credits		its	5	Course		23UCHGEC1		
	COURSE	Semester		Ι				Code		
Instructio	onal Hours	Lecture	Tut	orial	Lab Practice			Total		
nor wook	eek 5					5				
per week		3		-						e
Prerequis	site	12 th Standar	d Ma	- themati	cs					
Prerequis Objective	site es of the	12 th Standar 1.To acquire	d Ma e knov	themati wledge	cs in a the	eory of	equa	tions, Diff	fer	rential calculus,
Prerequis Objective Course	site es of the	12 th Standar 1.To acquire and Differen	d Ma e knov ntial e	themati wledge	cs in a the s.	eory of	equa	tions, Diff	fer	rential calculus,
Prerequis Objective Course	site rs of the	12 th Standar 1.To acquire and Differen 2.To unders	d Ma knov tial e tand	themati wledge equation the me	cs in a the s. thod o	eory of	equa ng al	tions, Diff gebraic eo	fer	rential calculus, ations using the
Prerequis Objective Course	site es of the	12 th Standar 1.To acquire and Differen 2.To unders transformation	d Ma knov tial e tand on of	themati wledge equation the me	cs in a the s. thod o ons.	eory of	equa 1g al	tions, Diff gebraic e	fer	rential calculus, ations using the

Course Outcomes:

Students will be able to

- **CO1:** Learn the concepts of matrices, theory of equations, differential calculus, ordinary and partial differential equations
- **CO2:** Analyze various methods to find roots of polynomial equations and inspect Horner's method and Newton's method to find approximate real roots
- **CO3:** Understand the concept of the angle between the radius vector and the tangent, radius of curvature, pedal equation, and Descartes rule of signs and solve related problems
- **CO4:** Solve specific types of ordinary and partial differential equations.

CO5: Analyze the method of Variation of parameters to solve ordinary differential equations. Lagrange's method to solve partial differential equations

Course Outline		
Course Outline		
	Theory of Equations	15 Hours
	Relation between the roots and coefficients of a	n equation,
	Imaginary and irrational roots, Symmetric functions of the	roots of an
	equation in terms of its coefficients (up to cubic equa	ations), and
	Reciprocal equation.	
	Chapter 6 (Page No: 6.2 - 6.37)	
	Unit - II	15 Hours
	Transformation of equation (Definition only), Multi	plication of
	roots by m (Definition only), Diminishing the roots of a	in equation,
	Removal of a term, Descartes' rule of sign, Descartes's rule	of signs for
	negative roots of an equation, Horner's method, Newton's	s method of
	evaluating a real root correct to given decimal places.	
	Chapter 6 (Page No: 6.38 - 6.67)	
	Unit - III	15 Hours
	Differential Calculus	
	The angle between the radius vector and the tangent, A	Angle of the
	intersection of two curves, the Length of a perpendicular from	n the pole to
	the Tangent, Pedal equation, The Cartesian formula for th	ne radius of
	curvature, and the Parametric formula for the radius of curvature	ture.
	Chapter 10 & 11(Page No: 10.1 - 10.23, 11.1 - 11.22)	
	Linit IV	15 Hours
	$\bigcup_{n=1}^{\infty} \bigcup_{n=1}^{\infty} \bigcup_{n$	13 110018
	Ordinary Differential Equations	

	Second order differential equations with constant coefficients,
	finding particular integral for the function $f(x)e^{ax}$, $\cos ax$, $\sin ax$, $\sinh ax$,
	$\cosh ax$, x^m , $e^{ax}v$ where v is any function of x, Linear homogeneous
	equation and Variation of parameter.
	Chapter 23 & 24 (Page No: 23.1 - 23.32, 24.1 - 24.23)
	Unit – V 15 Hours
	Partial Differential Equations
	Elimination of arbitrary constants, Elimination of arbitrary
	functions, Definitions - complete solution, singular solutions, General
	solutions, Standard types, Lagrange's linear partial differential equations
	(Charpit's method to be excluded).
	Chapter 26 (Page No: 26.1 - 26.40, 26.44 - 26.58)
Skills acquired	Knowledge, Problem Solving, Analytical ability, Professional
from the course	Competency, Professional Communication and Transferrable Skill
Recommended Text	P.R. Vittal - Allied Mathematics, Margham Publications, Chennai-17
Reference Books	T.K.Manicavachagam Pillai, Natarajan& K.S. Ganapathy - Algebra
	Volume-I, Viswanathan Publishers, Pvt. Ltd, 2004.
Web resources	1.http://www.universityofcalicut.info/SDE/VI%20Sem.%20B.Sc%2
	0Maths%20-
	%20Additional%20Course%20in%20lie%20of%20Project%20-
	Theory%20of%20equations%20&%20fuzzy%20set.pdf
	2. <u>https://sol.du.ac.in/pluginfile.php/4111/mod_resource/content/1/B.A.</u>
	<u>%20st%20m%204_1-7pdf</u>

Title of the Course	FOOD CHEMISTRY									
Course No.			Skill F	Inhanceme	nt C	ours	e-I			
Category		Vear	T			C				
	NME	Semester	I	Credits	2		irse de	23UCHSEC1		
Instructional	Lecture	Tutoria	al	Lab P	racti	ce		Total		
hours per week	2	-	2							
Prerequisites	Higher see	condary chem	istry							
Objectives of	This cours	se aims at giv	ing an	overall view	w of	the				
the course	 T Fo Fo Be Vi 	ypes of food ood adulterati ood additives overages tamins and M	on and and pr linerals	l poisons reservation s						
Course Outline	UNIT-I							6 Hours		
	Sources o contamina toxic cher Detection UNIT-II Food Pois Food Pois BHC, Ma consumed UNIT III Food addi Food addi Food flavo emulsifyin tastemake UNIT-IV	f food, types ation of whea nicals- comm of adulterated son sons- natural lathion, Mon- victims. itives tives- artifici ours- esters, a ng agents- pre- rs- MSG- vin	, advan t, rice, ion ad d foods poisor ocroto al swe ldehyd eservat egar.	ntages and , milk, butt ultrants, gh s by simple ns (alkaloid phos)- Che eteners- Sa les and hete ives- leaver	disac er et ee ac anal ds-ne mica cchar rocyc ning	dvant c. wi lulter ytical phrot l pois rin- C clic co agent	ages- th cla ation (techi toxin) sons- Cyclar ompo ts; Ba	Food Adulteration- y stones, water and and their detection; niques. 6 Hours - pesticides, (DDT, First aid for poison 6 Hours mate, and Aspartate. unds – food colours- king powder- yeast-		
	Beverage	8	6 Hours							
	Beverages Carbonatio	s- soft drinks- on- addiction	soda- to alco	soda- fruit juices - alcoholic beverages- examples. o alcohol- diseases of liver and social problems.						
	Vitamins	and Mineral	ls					6 Hours		
	Vitamins- diseases; I functions,	A, C, K, E, F Minerals- imp requirements	B_1, B_2 abortant and d	B_2 and B_6 , sources, requirements, deficiency ant minerals- Na, K, Mg, Fe, S and P, sources, ad deficiency diseases.						
Recommended Text	1. Jay S. 2. Jay S.C	yashree Ghos Chand, & Co yashree Ghosh Chand & Co 1	h. A, <i>T</i> 3 rd Ed n, <i>Fund</i> st Ed.	Fext Book oj ., 2003. damental C ., 2006.	f Pha once	irmac pts of	ceutico f Appl	al Chemistry, 'ied Chemistry,		

Reference	1.Belitz, H. D, Werner Grosch, Food Chemistry Springer Science and
Books	Buisness Media, 4 th Ed, 2009.
	2. Swaminathan M, Food Science and Experimental Foods, Ganesh and
	Company, 1979.
	3. Hasenhuettl, Gerard. L, & Hartel, Richard. W., Food Emulsifiers and
	their Applications Springer New York 2 nd Ed. 2008.
	4. Belitz, H. D, Grosch, W, Schieberle, P, Food chemistry, Springer,4th
	revised and Extended Ed, 2009.
	5. John, M, deMan John W, Finley, W. Jefferey Hurst, ChangYong
	Lee, Principles of Food Chemistry, Springer, 4th Ed, 2018.
Website and	1)https://gcwgandhinagar.com/econtent/document/1589361321Unit%20V%
e-learning	20Food%20adulteration.pdf
source	2) https://ccsuniversity.ac.in/bridge-library/pdf/Toxicology-2704-Health-&-
	hygiene-open-elec-Unit-III-Food-Poisoning-types-symptoms-treatments.pdf
	3) https://egyankosh.ac.in/bitstream/123456789/73121/1/Unit-7.pdf.
	4) https://ccsuniversity.ac.in/bridge-library/pdf/FST-Paper
	%20II%20Food%20Beverages-%20IV-Semester.pdf
	5) https://egyankosh.ac.in/bitstream/123456789/12390/1/Unit-9.pdf
Course Outcomes	s (for Mapping with POs and PSOs)
On completion of	the course the students should be able to
CO1: explain abou	ut food adulteration- contamination of wheat, rice, milk, butter.
CO2: identify for	ad paisang like natural paisang (alkalaida paphratavin) pagtigidag DDT

CO2: identify food poisons like natural poisons (alkaloids-nephrotoxin), pesticides, DDT, BHC, Malathion, Monocrotophos

CO3: describe food additives, artificial sweeteners, saccharin, cyclamate and aspartate in the food industries

CO4: classify beverages and illustrate their importance

CO5: outline the sources of vitamins and minerals and its significance

Title of the Course	FOUNDATION CHEMISTRY								
Course No.			Foun	dation Co	ourse	e			
Category	SEFC	YearICredits2CourseSemesterICodeCode						23UCHSEFC	
Instructional	Lecture	Tutor	rial	Lab P	racti	ce	Total		
hours per week	2	-			-			2	
Prerequisites	Higher second	lary chemis	try						
Objectives of the course	This course ai principle fundament	ms at provi s of volume ntal concept	ding ba tric and ts of in	asic know d inorgani organic, c	ledge ic sei organ	e on ni-micr ic and p	o a hy	nalysis sical chemistry	
	Basic concep Principles of terms - mola weight/volum problems. Bas anions, interf Common ion applications in	ts in volum volumetric rity, molal e percentag sic principle ering anior n effect, i n qualitative	etric a analy ity, fo e, ppn es of in us, sep onic e analy	nd inorg sis – Eq rmality, 1 n, normal, norganic s aration o product, sis.	anic uival norm deci semi f cat solu	semi m lent we ality, v inormal micro a ions in bility j	igh olu so ana to pro	o analysis t, concentration me/volume and lutions – simple lysis – common various groups. duct and their	
	Introduction Charges and electron, mes concept of at between orbit basicity of s oxidising ager chemical bond hydrogen bon atoms, molec cationic, anion	IT II 6 Hours roduction to atomic structure and chemical bonding rges and masses of fundamental particles like proton, neutron, etron, meson and positron. Atomic structure - atomic orbitals and cept of atomic orbitals, shapes of s, p and d orbitals, difference ween orbit and orbitals, sigma and pi bonds, oxidation state, acidity, acity of simple molecules, definition and examples of reducing, dising agents, oxides, oxo acids, metallic and non-metallic elements, mical bonding – types, ionic bond, covalent bond, co-ordinate bond, rogen bonding, vander Waal's bond, metallic bond, definition of ions, ns, molecules, compound, mixture, co-ordination complex- neutral, onic anionic co-ordination number ligends types							
	UNIT III IUPAC nome Introduction compounds- c homologous s compounds (ethers, acids, o	enclature of to organic yclic, acycl series, funct Alkanes, al esters, amin	f organ chemi ic, ope tional g kenes, es).	nic compo stry - ge n chain an groups, IU alkynes,	ound neral nd clo JPAC alco	s classif osed ch nome ohols, a	rica ain ncl lde	6 Hours attion of organic with examples- ature of organic chydes, ketones,	

	UNIT IV 6 Hours
	Gaseous and liquid state
	Mathematical concepts applied to chemistry- some useful physical
	constants, important conversion factor, Greek alphabets, States of Matter
	- colloidal state, gaseous state- statements of gas laws- Boyle's law.
	Charles law, Avogadro law, ideal gas equation, liquid state- vapour
	pressure surface tension viscosity solutions- pH range simple
	calculations involving pH and pOH
	calculations involving pri and port.
	UNIT V 6 Hours
	Chemical equilibria and chemical kinetics
	Chemical equilibria, law of mass action homogeneous and beterogeneous
	equilibria with examples, chemical kinetics, rate of reaction, order and
	molecularity of reaction, first and second order reaction with examples
	A mboning equation and its terms, energy berniar diagram for exothermic
	Annemus equation and its terms, energy barrier diagram for exotilerinic
	and endomermic reactions.
Skills acquired	Knowledge Problem solving Analytical ability Professional
from this course	Competency, Professional Communication and Transferable skills
B acammandad	1 Verketeswaran V · Veraswaray \mathbf{P} · Kulandiyelu $\mathbf{A} \mathbf{P}$ Rasic
Toyt	Principles of Practical Chemistry, Sultan Chand & Sons: New Dolhi 2 nd
ΙζΛί	Ed. 1007
	Lu., 1997. 2 Maden B. D. and Sathya Drokach, Madem Inanagnia Chamistry, S.
	2. Madan, K. D. and Saurya Flakash, <i>Modern Inorganic Chemistry</i> , S.
	Chand and Company: New Denn, 2 Ed., 2005.
	5. Jain, M.K & Sharina, S.C., <i>Modern Organic Chemistry</i> , Vishal
	Publishing, 4 th reprint, 2005.
	4. Puri, B. R. & Sharma, L. R. Principles of Physical Chemistry,
D . f	Visnai Publishing Company: Jalandhar, 38 th Ed.,2002.
Reference	1. Morrison R.1, & Boyd, R.N, Organic Chemistry, Pearson Education,
BOOKS	Asia, 6^{th} Ed, 2012.
	2. Lee, J. D. Concise Inorganic Chemistry, 4 th Ed.; ELBS William
	Heinemann: London, 1991.
	3. Atkins, P.W. & Paula, J. <i>Physical Chemistry</i> , Oxford University
***	Press: New York, 10 th Ed., 2014.
Website and	1) <u>https://onlinecourses.nptel.ac.in</u>
e-learning	2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm
source	3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html
	4) <u>https://swayam.gov.in/course/64-atomic-structure-and-chemical-</u>
	bonding
	5) https://www.chemtube3d.com/
Course Outcome	es (for Mapping with POs and PSOs)
On completion o	f the course the students should be able to
CO1: explain bas	ic principles of inorganic semi micro analysis and titrimetry
CO2: classify diff	ferent types of bonds in compounds and explain the atomic structure
CO3: assign the r	nomenclature of organic compounds based on IUPAC
CO4: solve proble	ems related to concentration terms and pH of solutions
CO5: apply the m	nathematical concepts and physical constants in solving problems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	М	М	М	М	S	S	S
CO3	S	S	S	М	М	М	М	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

CO-PO Mapping (Course Articulation Matrix)

Level of Correlation Between PSO's and CO

	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

SECOND SEMESTER

Title of the	GENERAL CHEMISTRY-II									
Course										
Course No.	Core C	Core Course -III								
Category	Core	Yea	r	Ι	C	redits	5	Cours	e	23UCHCC2
		Sem	ester	ΙΙ				Code		
Instructional	Lectur	e	Tutor	ial		Lab Prac	ctice		Te	otal
hours per week	4	4 1 - 5								
Prerequisites	Genera	General Chemistry I								
Objectives of	This c	ourse	aims at	provid	din	g an overal	ll vie	ew of the	e	
the course	• che	emistr	y of aci	ds, bas	ses	and ionic	equi	librium		
	• app	olicati	ons of a	cids a	nd	bases				
	• pro	opertie	s of s a	nd p-b	oloc	ck elements	S			
	• che	emistr	y of hyc	lrocar	boi	ns				
	• coi	npour	nds of m	nain bl	OC.	k elements	and	hydroca	arbo	ons
Course Outline	UNIT	-I		•						15 Hours
	Conce concep dissoc water, effect, theory orange Buffer buffer, Salt hy strong of hyd hydrol Solubi	pts of pt, Le iation pH sc facto of aci s, titrat soluti , Henc vdroly acids trolysi ysis lity p	Acids wis co constan cale, pH rs affec id -base tion cur ions – ty lerson-H sis - sal , weak a s and re	and E oncept it; diss of so ting c indica ves - u ypes, r Hassel ts of v acids a elation - dete	Bas , I soc lut leg ato use med bal wea and n bo	es - Arrhe Relative st iation of po- ions; Degra ree of diss rs – action of acid -ba chanism of ch equation ak acids an l weak base etween hype	nius treng bly b ee of socia of p ase i buff n. d str es - 1 droly l app	concep gths of pasic acid f dissoci ation; ac ohenolph ndicator fer, actio rong bas hydrolys vsis cons	ot, 1 ac ds, atic cid- ntha rs. on i es, sis c star s, n	Bronsted-Lowry ids, bases and ionic product of on, common ion base indicators, ilein and methyl n acid and basic weak bases and constant, degree at and degree of
	proble	ms in	volving	the co	ore	concepts.				
	UNIT Hours	-II								15
	Chem Hydro Compa halidea Mg. Pr metals Chem Prepar borax. Compa and per	istry of gen: I arative s, carb roperti . Anon istry of ation Extra urison r dicar	of s - Bl Position e study oonates ies and to malous of p- Bl and struction of of carbo	ock E of hy of the and bi uses of behav ock E ructure Al an on wit	Cler dro electrication f N iou ler ler d i h s	nents ogen in the ements with rbonates. E aOH, Na ₂ O ar of Be. nents (Gro of diborand its uses. Al ilicon. Pero	e per h res Diago CO ₃ , Dup e an loys carbo	riodic ta pect to o onal rela KBr, K 13 & 14 d boraz of Al. onates- j	(ble oxio ction ClC () tine per	 Alkali metals: des, hydroxides, nship of Li with O₃, alkaline earth Chemistry of monocarbonates

UNIT-III

15 Hours

Chemistry of p- Block Elements (Group 15-18)

General characteristics of elements of Group 15; chemistry of H₂N-NH₂, NH₂OH, HN₃ and HNO₃. Hybridisation and structure of PH₃, PCl₅, POCl₃, P₂O₅ and oxy acids of phosphorous (H₃PO₃ and H₃PO₄). General properties of elements of group16 - Structure and allotropy of elements - Classification and properties of oxides - oxides of sulphur and selenium – Oxo acids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens: General characteristics of halogen with reference to electronegativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxo acids (HClO₄). Inter-halogen compounds (ICl, ClF₃, BrF₅ and IF₇), pseudo halogens [(CN)₂ and (SCN)₂] and basic nature of Iodine.

Noble gases: Position in the periodic table. Hybridisation and structure of XeF_2 , XeF_4 , XeF_6 and $XeOF_4$; uses of noble gases - clathrate compounds.

UNIT-IV

Hydrocarbon Chemistry-I

Petroproducts: Fractional distillation of petroleum; cracking,

isomerisation, alkylation, reforming and uses

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

Alkadienes

Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2- and 1, 4 -additions; free radical addition to conjugated dienes – Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanization. **Alkynes**

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

Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes.

UNIT-V

Hydrocarbon Chemistry - II

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

15 Hours

15 Hours

	Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity. Polynuclear Aromatic hydrocarbons : Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at alpha - position – reduction, oxidation – uses. Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.
Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired	Knowledge, Problem solving, Analytical ability, Professional
from this course	Competency, Professional Communication and Transferable skills.
Recommended	1. Puri B. R., Sharma L. R., Principles of Physical Chemistry, Vishal
Text	 Publishing Company, Jalandhar. 38th Ed., 2002. Puri B. R., Sharma L. R., Kalia K. C., <i>Principles of Inorganic Chemistry</i>, Milestone Publishers & Distributors, 31st Ed., 2013. Madan R. D., Sathya Prakash, <i>Modern Inorganic Chemistry</i>, S.Chand and Company, New Delhi., 2nd Ed., 2003. Sathya Prakash, Tuli G. D., Basu S. K. & Madan R. D., <i>Advanced Inorganic Chemistry</i>, S.Chand and Company, New Delhi., 17th Ed., 2003. Bahl B. S. & Arul Bhal, <i>Advanced Organic Chemistry</i>, S.Chand and Company, New Delhi., 3rd Ed., 2003. Tewari K. S., Mehrothra S. N. & Vishnoi N. K., <i>Text book of Organic Chemistry</i>, Vikas Publishing House, New Delhi, 2nd Ed., 1998.
Keference Books	 Maron S. H. Prutton C. P., <i>Principles of Physical Chemistry</i>, The Macmillan Company, New York. 4th Ed., 1972. Barrow G. M., <i>Physical Chemistry</i>, Tata McGraw Hill, New Delhi. 5th Ed.,1992. Lee J.D, <i>Concise Inorganic Chemistry</i>, ELBS William Heinemann, London. 4thEd., 1991. Huheey J. E., <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, Addison Wesley Publishing Company, India. 4th Ed., 1993. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i> Vol – I, Goel Publishing House, Meerut. 26th Ed., 2001. Agarwal O. P., <i>Reactions and Reagents in Organic Chemistry</i>. Goel

	Publishing House, Meerut. 8 th Ed., 1995.
Website and e-	https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem10
learning source	10/lecture_notes/4B.html
	http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/co
	urse/64-atomic-structure-and-chemical-bonding
	MOOC components
	http://nptel.ac.in/courses/104101090/
	Lecture 1: Classification of elements and periodic properties
	http://nptel.ac.in/courses/104101090/
Course Learnin	g Outcomes (for Mapping with POs and PSOs)
On completion	of the serves the students should be able to
On completion	of the course the students should be able to
CO1: explain t	theories of acids, bases and indicators, buffer action and important
compour	nds of s-block elements.
CO2: identify	the concept of acids, bases and ionic equilibria; periodic properties
of s and	p-block elements, preparation and properties of aliphatic and
aromatic	hydrocarbons.
CO3: compare	the periodic properties of s and p- block elements, reactions of
aliphatic	and aromatic hydrocarbons and strength of acids.
CO4: interpret	hydrocarbon classification, types of reactions, acids and bases,
determin	e the properties s and p-block elements, reaction mechanisms of
aliphatic	and aromatic hydrocarbons.
CO5: predict t	he applications of acid-base indicators, buffers, compounds of s and
p- block	elements and hydrocarbons.
	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	М	S	S	S	S
CO2	S	S	S	S	S	М	S	S	S	S
CO3	S	S	S	S	S	S	Μ	S	S	S
CO4	S	S	S	М	М	М	Μ	S	S	S
CO5	S	S	S	М	S	S	S	М	S	S

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	2	2	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	14	14	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

CO-PO Mapping (Course Articulation Matrix)

Level of Correlation between PSO's and CO's

Board of Studies Date : 02.11.2023

Title of the Course	QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS						
Course No.		С	ore C	ourse – IV	Co	re Practical -I	I
Category	Core	Year	Ι	Credits	3	Course	23UCHCCQ2
		Semester	II			Code	
Instructional	Lecture	Tutorial	La	b Practice	e		Total
hours per week	1	-		3			4
Prerequisites				General C	Chem	istry II	
Objectives of		This	cours	e aims at p	rovi	ding knowledge	e on
the course	• laborate	ory safety					
	• handlin	ig glass ward	es				
	• analysi	s of organic	comp	ounds			
	• prepara	tion of orga	nic co	mpounds			
Course Outline	UNIT I						10 Hours
	Safety rule	s symbols a	nd fir	st-aid in ch	emi	stry laboratory	
	Basic ideas	about Runs	en hu	mer its on	erati	on and parts of	the flame Chemistry
	laboratory	olassware –l	nasic i	nformation	and		the frame.enemistry
	luborutory	51455 11410	Jusie I	mormation	unu	4505	
	UNIT II						25 Hours
	Qualitativ	• Organic /	nalve	ic			
	Preliminar	v examinati	on de	tection of	snec	ial elements - 1	nitrogen sulphur and
	halogens	y examinati	on, uc		spec	iai cicilicitis - i	ntrogen, surphur and
	Aromatic	and alinhati	c nati	ire Test fo	or sa	turation and m	nsaturation
	identificat	ion of functi	onal a	rouns using	ים המ מ גמו	ubility tests	insuturation,
	Confirmat	ion of funct	ional g	roups using	5 301	donity tests	
		monocarb	oxvlic	acid dica	rhov	vlic acid	
		monobud	ria nh	nol nolyh	udri	a phonol	
		aldahuda	le più	a astar	yun	e phenoi	
	•	aluenyde,	Kelon	e, ester	d	n naduain a arra	
	•	carbonydi	ale (r	educing an	u no	in-reducing sug	ars)
	•	primary,	second	ary, tertiar	y an	nine	
	•	monoami	de, dia	amide, thio	amıc	le	
	•	anilide, n	itro co	mpound			
	•	Preparatio	on of c	lerivatives	for f	functional grou	ps

	UNIT III 25 Hours
	Preparation of Organic Compounds
	 i. Nitration - picric acid from Phenol ii. Halogenation - p-bromo acetanilide from acetanilide iii. Oxidation - benzoic acid from Benzaldehyde iv. Microwave assisted reactions in water: v. Methyl benzoate to Benzoic acid vi. Salicylic acid from Methyl Salicylate vii. Rearrangement - Benzil to Benzoic Acid viii. Hydrolysis of benzamide to Benzoic Acid
	Separation and Purification Techniques (Not for Examination)
	1. Purification of organic compounds by crystallization (from water / alcohol)and distillation
	2. Determination of melting and boiling points of organic compounds.
	3. Steam distillation - Extraction of essential oil from citrus fruits/eucalyptus leaves.
	4. Chromatography (any one) (Group experiment)
	(i) Separation of amino acids by Paper Chromatography
	(ii)Thin Layer Chromatography - mixture of sugars / plant pigments dichromate/permanganate
	(iii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate.
	5. Electrophoresis – Separation of amino acids and proteins. (Demonstration)
	6. Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5& 6–not for ESE)
Reference Books	 Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. <i>Basic Principles of Practical Chemistry</i>, Sultan Chand: New Delhi, 2nd Ed., 2012. Manna, A.K. <i>Practical Organic Chemistry</i>, Arunabha Sen, Books and Allied (P) LTD: Kolkata,2018. Gurtu, J. N; Kapoor, R. <i>Advanced Experimental Chemistry (Organic)</i>, Sultan Chand: New Delhi, 1987. Furniss, B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. <i>Vogel's Textbook of Practical Organic Chemistry</i>, Pearson: India, 5th Ed.,1989.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: observe the physical state, odour, colour and solubility of the given organic compound.

- **CO2:** identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.
- **CO3:** compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.
- **CO4:** exhibit a solid derivative with respect to the identified functional group.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	М	S	М
CO2	М	S	S	S	Μ	S	S	М	М	М
CO3	S	S	S	М	S	S	S	М	S	М
CO4	S	S	S	S	S	S	S	М	М	М

CO-PO Mapping (Course Articulation Matrix)

CO /PO	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
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Board of Studies Date : 02.11.2023

Title of the	e Course	e	INTEGRA	L CA	LCU	LUS	AND LA	PLA	CE	TRANSFORM
			(FOR I B.S	Sc. CI	IEM	ISTR	Y)			
Paper Nun	nber		ELECTIV	EII (GE)					
Category	ELEC'	TIVE	Year	Ι	Cree	dits	3	Cou	irse	23UCHGEC2
	COUR	SE	Semester	II				Cod	le	
Instruction	nal Hou	rs	Lecture	Tuto	orial	Lab	Practice)	Tot	al
per week			3		•		-			3
Prerequisi	te		12 th Standar	rd Ma	thema	atics				
Objectives	of the		1.To acquir	the l	know	ledge	in integra	al cal	culus	, Fourier series
Course			and Laplace	e trans	sform	•	-			
			2. To under	stand	the m	etho	d of doing	g prot	olems	s using the above
			concepts.							
			3. To analyse is the different methods of solving differential						g differential	
			equations u	sing t	he La	place	transform	n		
Course O	utcome	s:								
Students v	vill be a	ble to								
CO1: lear	n the no	tions of	f multiple int	tegrals	s and	Lapla	ce transfo	orms		
CO2: Und	lerstand	the cha	ange of order	of in	tegrat	ion, F	Fourier co	effici	ents,	odd and even
func	ctions ar	nd solve	ed related pro	oblem	s.					
CO3: anal	lyse the	propert	ties of integra	ation t	o eva	luate	double a	nd trij	ple in	tegrals and
Fou	rier seri	es.								
CO4: inte	rpret the	e prope	rties of Lapla	ace tra	nsfor	m, in	verse Lap	lace	transf	form and
solv	ve the re	lated pr	oblems.							
CO5: app	ly Lapla	ice tran	sform and in	verse	Lapla	ice tra	ansform to	o solv	ve the	e differential
equa	ations									
Course O	utline	Unit –	- I (Hours: 9)						
		Integra	al Calculus							
		Multip	ole Integrals,	Evalu	ation	of do	ouble inte	grals,	Dou	ble integral in
		polar c	co- ordinates	. Cha	pter 2	20 (se	ctions 20	.1-20).17)	-
	-	•			-				-	
		Unit –	II (Hours: 9))						
		Triple	integrals, Cha	nge of	order	of int	egration. a	applic	ations	s of double
		and trip	ple integrals to	o area	volum	e and	centroid.			
		Chapt	er 20 (section	s 20.1	8 -20.4	44)				
	-	Unit –	III (Hours: 9)						
		Fourie	er Series							
		Definit	tion, Finding	Fourie	er seri	es foi	a given	perio	dic fu	inction with
		period	2π , Fourier se	ries fo	r odd	and e	ven function	ons.		
		Chapt	er 21 (section	s 21.1	-21.40)				
		Unit –	IV (Hours: 9)						
		Laplac	e Transform	l						
		Definit	ion, Laplace	trans	sform	of e	elementary	/ fun	ctions	s, Linearity
		propert	ty, shifting pro	operty,	Chan	ge of S	Scale prop	erty, l	Lapla	ce transform
		of deriv	vatives.	<i>c</i> =						
	ļ	Chapt	er 27 (section	s 27.1	-27.20)				
		Unit –	V (Hours: 9)		-					
		Inverse	e Laplace tran	sform,	solvi	ng dif	ferential e	quatio	ons us	sing Laplace

	transform. (Simultaneous equations are to be excluded).
	Chapter 27 (sections 27.23-27.57)
	(Section 5: Examples1-10 only, Exercise 4:1-26only)
Skills acquired	Knowledge, Problem-Solving, Analytical ability, Professional
from the course	Competency, Professional Communication and Transferrable Skill
Recommended	P.R.Vittal, Allied Mathematics, Margham Publications, Chennai-1
Text	
Reference	S. Narayanan and T. K. Manicavachagam Pillay, Calculus -
Books	Volume III, S. Viswanathan
	(Printers and Publishers), Pvt., Ltd,2011.
Web resources	1. https://nptel.ac.in

Title of the Course		THEORY OF EQUATIONS AND LAPLACE									
		TRANSFORM USING SAGE MATH- PRACTICAL									
			(FOD I D S. CHEMISTERY)								
		(FOR I B.S	(FUK I B.SC CHEMISTRY)								
Paper Num	ber	EC – PRAC	EC – PRACTICAL								
Category	ELECTIV	E Year	Ι	Cre	dits	2	Cou	irse	23UCHMGECQ		
	COURSE	Semester	Π				Cod	le			
Instruction	al Hours pe	r Lecture	Tuto	rial	Lab)		Tot	al		
week	-				Pra	ctic	e				
		-	-			2			2		
Prerequisit	e	Basic know	ledge i	n dat	a and	rep	resen	tatio	ns		
Objectives	of the	The main obj	jectives	s of th	is cou	rse	are:				
Course		I. Tow	ork wi	th inte	erpola	tion	and a	pprox	simation methods in		
		2 To 1	ng root Itilize (s usm Sage	ig Sag Math	to p	uii. erforr	n eur	nbolic and numerical		
		2. IOU	pration	ager	Lanl	ace	Trans	n syl sform			
Course Or	itcomes:	integ			Lupi		114115	,10111			
Students w	ill be able to										
CO1: learr	the notions	of approximati	on of s	oluti	ons, I	Lapl	ace tr	ansfo	orms, inverse		
Lapl	ace transfor	n and basic ope	ration	s, con	nman	ds v	vithin	n Sage	eMath		
CO2: unde	erstand the f	indamental prin	ciples	of or	dinar	y di	fferer	ntial e	equations and		
num	erical integr	ations using Sag	geMatl	n to se	olve t	hen	n accu	iratel	У		
CO3: appl	y the Laplac	e, Inverse Lapla	verse Laplace Transforms to solve linear differential equations								
in Sa	ageMath.		1.1.	1		:		1			
CO4: anal	yze the appl	cation of Sager	viath 11	1 SOIV	ing a	ine	rentia	u equ	ations in		
CO5. eval	uate multinl	integrals and	non-lii	near e	anati	ons	with	accu	racy using		
Sage	Math while	demonstrating of	critical	thinl	cing s	kill	S	accu	lacy using		
Course O	utline Uni	t I: Theory of	Equat	ions	0 -		~				
	Dro	• blems on Finding	tha ro	ots of	tha a	tour	ione u	sing t	ha		
	Sag	Math.	g the to	015 01		quai	ions u	sing t			
	(Pa	ge No: 139-140)								
	Uni	t II: Non-Linea	ar Equ	atio	ns						
	Nu	nerical Solutior	n: Loca	ation	of so	luti	ons o	f Alg	gebraic equations and		
	Iter	ative Approxim	ation N	Metho	ods us	sing	Sage	Math	l.		
	(Pa	ge No: 263-278)								
	Uni	t III: Multiple	integr	al							
	Ava	ilable Integration	on Fun	ction	s, Mu	ıltip	le Int	egral	s using SageMath		
	(Pa	ge No: 305-317)		, -	r		U			
	Uni	t IV: Laplace I	Equati	ions							
	0.1			1) (- 4)-		
	Sol	ing problems o	on Lap	lace t	ransf	orm	s usin	ig Sa	geiviath		
	(Pa	ge No: 225)		-	6						
	Uni	t V: Inverse La	aplace	Trai	istor	ms					

	Solving problems on Inverse Laplace transformations using
	SageMath
	(Page No: 226)
Skills acquired	Computational Mathematics with SageMath
from the course	
Web resources	https://archive.nptel.ac.in/courses/111/106/111106149/

Course	Dairy Che	mistry							
Course No.	Skill Enh:	ancement Co	urse-l	II					
Category	NIME	Year	Ι	Credita	2	Course	22UCUSEC2		
		Semester	II	Creans	4	Code	25UCHSEC2		
Instructional	Lecture	Tutorial	La	b Practice	e		Total		
hours per week	2	-		-			2		
Prerequisites	Higher sec	condary chemi	stry						
Objectives of	This cours	This course aims at providing an overall view of the							
the course	• chemi	 chemistry of milk and milk products processing of milk 							
	 proces preser 	 processing of milk preservation and formation of milk products 							
	• preser	vation and 101	mane		510	uucis.			
Carrier Oradian									
Course Outline							6 Hours		
	Composit	ion of Milk		acition of		ille consti	tuants of mills		
	lipids pro	oteins carbol	vdrat	tes vitami	ins	and mine	erals - physical		
	properties	of milk - col	our, o	odour, acid	lity	, specific g	gravity, viscosity		
	and cond	uctivity -Fac	tors	affecting	the	composi	tion of milk -		
	adulterants	s, preservativ	ves	with neu	tra	lizer-examp	ples and their		
	detection-	estimation of t	fat, ac	idity and to	ota	l solids in n	nilk. Comparison		
	of A1 and	A2 milk							
	UNIT II						6 Hours		
	Processing	g of Milk							
	Processing Microbiolo	g of Milk ogy of milk	- des	truction of	f n	nicro - org	anisms in milk,		
	Processing Microbiolo physico –	g of Milk ogy of milk chemical cha	- des nges	truction of taking place	f n ce i	nicro - org in milk due	anisms in milk, to processing -		
	Processin Microbiolo physico – boiling, pa HTST (Hit	g of Milk ogy of milk chemical chat asteurization	- des nges – typ re Sho	truction of taking places of past	fn ce eur Va	nicro - org in milk due rization -B	anisms in milk, e to processing - ottle, Batch and		
	Processin Microbiolo physico – boiling, pa HTST (Hig High Tem	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste	- des nges – typ re Sho urizat	truction of taking plac es of past ort Time) – tion.	fn ce eun Va	nicro - org in milk due rization -B acuum paste	anisms in milk, e to processing - ottle, Batch and eurization – Ultra		
	Processin Microbiolo physico – boiling, pa HTST (Hig High Tem	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste	- des nges – typ re Sho eurizat	truction of taking plac es of past ort Time) – tion.	fn ce eun Va	nicro - org in milk due rization -B acuum paste	anisms in milk, e to processing - ottle, Batch and eurization – Ultra		
	Processin Microbiolo physico – boiling, pa HTST (Hig High Temp	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste	- des nges – typ re Sho urizat	truction of taking plac es of past ort Time) – tion.	fn ce teun Va	nicro - org in milk due rization -B acuum paste	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours		
	Processing Microbiolo physico – boiling, pa HTST (Hig High Temp UNIT III Major Mi	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste	- des nges – typ re Sho urizat	truction of taking place es of past ort Time) – tion.	f n ce : Va	nicro - org in milk due rization -B acuum paste	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours		
	Processing Microbiolo physico – boiling, pa HTST (Hig High Temp UNIT III Major Mi Cream - d gravitation	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste 	- des nges – typ re Sho ourizat	truction of taking place es of past ort Time) – tion.	f n ce : Va	nicro - org in milk due rization -B iccuum paste	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours aming process - cream - Butter -		
	Processing Microbiolo physico – boiling, pa HTST (Hig High Tem) UNIT III Major Mi Cream - d gravitation definition	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste Ik Products lefinition - co nal and centrifu- composition	- des nges – typ re Sho urizat ompos ugal r - theo	truction of taking place es of past ort Time) – tion. ition - che nethods of rv of churn	f n ce : Va Va	nicro - org in milk due rization -B acuum paste istry of cre paration of a – desi butt	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours aming process - cream Butter - er - salted butter.		
	Processing Microbiolo physico – boiling, pa HTST (High High Tem UNIT III Major Mi Cream - d gravitation definition estimation	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste Ik Products lefinition - co nal and centrifu- composition of acidity an	- des nges – typ re Sho urizat	truction of taking place es of past ort Time) – tion. ition - che nethods of ry of churn oisture con	f m ce : Va Va	nicro - org in milk due rization -B icuum paste stry of cre paration of g – desi butt nt in butte	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours aming process - cream Butter - er - salted butter, r. Ghee - major		
	Processin Microbiolo physico – boiling, pa HTST (Hig High Tem UNIT III Major Mi Cream - d gravitation definition estimation constituen	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste Ik Products lefinition - co nal and centrifi- composition of acidity an ts - common a	- des nges – typ re Sho urizat ompos ugal r - theo nd m adulte	truction of taking place es of past ort Time) – tion. ition - che nethods of ry of churn oisture con grants adde	f n ce va va emi sej ing nte d t	nicro - org in milk due rization -B acuum paste stry of cre paration of g – desi butt nt in butte o ghee and	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours aming process - cream Butter - cre - salted butter, r. Ghee - major their detection -		
	Processing Microbiolo physico – boiling, pa HTST (Hig High Tem UNIT III Major Mi Cream - d gravitation definition estimation constituen rancidity-	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste Ik Products lefinition - co al and centrifu -composition of acidity and ts - common a definition - products	- des nges – typ re Sho urizat ompos ugal r - theo nd m adulte event	truction of taking place es of past ort Time) – tion. ition - che nethods of ry of churn oisture con grants adde ion - antioy	f n ce eui Va emi se ing nte d t	nicro - org in milk due rization -B icuum paste istry of cre paration of g – desi butt nt in butte o ghee and ants and sy	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours aming process - cream Butter - eer - salted butter, r. Ghee - major their detection - nergists - natural		
	Processin Microbiolo physico – boiling, p HTST (Hig High Tem UNIT III Major Mi Cream - d gravitation definition estimation constituen rancidity- and synthe	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste 	- des nges – typ re Sho ourizat ompos ugal r - theo nd m adulte event	truction of taking place es of past ort Time) – tion. ition - che nethods of ry of churn oisture con orants adde ion - antios	f n ce Va Va	nicro - org in milk due rization -B acuum paste astry of cre paration of g – desi butt nt in butte o ghee and ants and sy	canisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours caming process - cream Butter - cream Butter - cream Butter - ter - salted butter, r. Ghee - major their detection - nergists - natural		
	Processing Microbiolo physico – boiling, pa HTST (Hig High Tem) UNIT III Major Mi Cream - d gravitation definition estimation constituen rancidity- and synthe Perspectiv milk produ	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste ilk Products lefinition - co nal and centrifu- composition of acidity and ts - common a definition - provic. es for food te	- des nges – typ re Sho urizat ompos ugal r - theo nd m adulte event	truction of taking place es of past ort Time) – tion. ition - che nethods of ry of churn oisture con orants adde ion - antioz	f n ce veur Va va emi sej ing nte d t xid eal	nicro - org in milk due rization -B icuum paste istry of cre paration of g – desi butt nt in butte o ghee and ants and sy th benefits	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours aming process - cream Butter - er - salted butter, r. Ghee - major their detection - nergists - natural of A2 milk and		
	Processing Microbiolo physico – boiling, pa HTST (Hig High Tem UNIT III Major Mi Cream - d gravitation definition estimation constituen rancidity- and synthe Perspectiv milk produ	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste ilk Products lefinition - co nal and centrifu- composition of acidity and ts - common a definition - pro- xtic. es for food te acts.	- des nges – typ re Sho urizat ompos ugal r - theo nd m adulte event	truction of taking place es of past ort Time) – tion. tition - chen nethods of ry of churn oisture con rrants adde ion - antios	f n ce va va va emi sej ing ing ing d t xid eal	nicro - org in milk due rization -B icuum paste stry of cre paration of g – desi butt nt in butte o ghee and ants and sy th benefits	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours aming process - cream Butter - er - salted butter, r. Ghee - major their detection - nergists - natural of A2 milk and		
	Processin Microbiolo physico – boiling, p HTST (Hig High Tem UNIT III Major Mi Cream - d gravitation definition estimation constituen rancidity- and synthe Perspectiv milk produ	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste alk Products lefinition - conal and centrifu- composition of acidity and ts - common a definition - protic. es for food te acts.	- des nges - typ re Sho ourizat ompos ugal r - theo nd m adulte event	truction of taking place es of past ort Time) – ion. ition - che nethods of ry of churn oisture con grants adde ion - antios	f n ce ieun Va emi sej ing nte d t xid eal	nicro - org in milk due rization -B- acuum paste acuum paste scuum paste scuum paste astry of cre paration of g – desi butt nt in butte o ghee and ants and sy th benefits	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours aming process - cream Butter - cre - salted butter, r. Ghee - major their detection - nergists - natural of A2 milk and		
	Processing Microbiolo physico – boiling, p HTST (Hig High Tem) UNIT III Major Mi Cream - d gravitation definition estimation constituen rancidity- and synthe Perspectiv milk produ	g of Milk ogy of milk chemical cha asteurization gh Temperatur perature Paste alk Products lefinition - conal and centrifu- composition of acidity and ts - common a definition - provic. es for food te acts.	- des nges – typ re Sho urizat ompos ugal r - theo nd m adulte event	truction of taking place es of past ort Time) – tion. ition - che nethods of ry of churn oisture con rrants adde ion - antioz	f n ce : va Va va sej ing nte: d t xid eal	hicro - org in milk due rization -B icuum paste actuum paste stry of cre paration of g – desi butt nt in butte o ghee and ants and sy th benefits	anisms in milk, e to processing - ottle, Batch and eurization – Ultra 6 Hours aming process - cream Butter - er - salted butter, r. Ghee - major their detection - nergists - natural of A2 milk and		

	UNIT IV 6 Hours
	Special Milk Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk – vitaminized milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk – condensed milk - definition, composition and nutritive value.
	UNIT V6 HoursFermented and other Milk ProductsFermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - Bulgarious milk -acidophilous milk – Yoheer - Indigeneous products- khoa and chhena definition - Ice cream -definition-percentage composition-types-ingredients-manufacture of ice–cream, stabilizers – emulsifiers and their role-milk powder- definition-need for making milk powder- drying process-types of drying Milk based health food
Recommended Text	 I. Bagavathi Sundari K, <i>Applied Chemistry</i>, MJP Publishers, 1st Ed, 2006. Rangappa K.S, Acharya K. T, <i>Indian Dairy Products</i>, Asia Publishing House New Delhi, 1974. Mathur M.P, Datta Roy D, Dinakar P, <i>Text book of Dairy Chemistry</i>, Indian Council of Agricultural Research, 1st Ed, 2008. Saurav Singh, <i>A Text book of dairy chemistry</i>, Daya Publishing house, 1st Ed, 2013. Choudhary P. L, <i>Text book of Dairy Chemistry</i>, Bio-Green book Publishers, 2021.
Reference Books	 Robert Jenness, Patom S, Principles of Dairy Chemistry, S. Wiley, New York, 2005. Wond F.P, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980. Fox P.F, Mcsweeney P.L.H, Dairy Chemistry and Biochemistry, Springer, 2nd Ed, 2016. Fox P.F, Uniacke-Lowe T, McSweeney P.L.H, OMahony J.A, Dairy Chemistry and Biochemistry, Springer, 2nd Ed, 2015.
Website and e-learning source	

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

- **CO 1:** discuss about general composition of milk constituents and its physical properties.
- **CO 2:** describe pasteurization of milk and various types of pasteurization -Bottle, Batch and Ultra High Temperature Pasteurization.

- **CO 3:** distinguish between cream and butter, their composition and how to estimate fat in cream and Ghee
- **CO 4:** explain about homogenized milk, flavoured milk, vitaminised milk and toned milk.
- **CO 5:** Summarize different types of drying process of milk.

Board of Studies Date : 02.11.2023

Title of the Course	INHERITED KNOWLEDGE IN COSMETIC CHEMISTRY									
Course No.	Skill Enh	ancement C	ourse	-III (Indian	Kn	owledge Syst	tem)			
Category		Year	Ι							
	SEC	Semester	II	Credits	2	Course Code	23UCHS EC3			
Instructional	Lecture Tutorial Lab Practice Total									
hours per week	2 2									
Prerequisites	Higher sec	ondary Chem	nistry							
Objectives of	This course	e aims at fam	iliariz	ing the stude	ents	with				
the course	• for	mulations of	vario	us types of c	cosm	etics and thei	r			
	sig	nificance								
	• ha	ir, skin and d	ental o	care						
	• ma	akeup prepara	tions	and persona	l gro	oming				
Course Outline	UNIT I					6	Hours			
	Skin care:	Ancient and	l mod	lern perspe	ctive	;				
	Indian Kno	owledge syste	em foi	cosmetics-	Dina	acharya for h	ealthy skin,			
	ayurvedic	formulations	for s	kin care- co	osme	tic tailams, (Ghritas and			
	Kosta etc.	Nutrition of the	ne skii	n, skin care a	ind c	leansing of th	e skin; face			
	powder – 1	ngredients; c	reams	and lotions	-cl	eansing, mois	sturizing all			
	purpose, sl	kin tonics - k	ey ing	gredients, ski	in lig	ghtness.				
			P TT.	•	I D	6	Hours			
	Ancient Io	rmulations i	or Ha	air care and		ntal care	and madam			
	Sanskrit of	room liquid	ipoo, i	lypes of sna	mpo	o- traditional	and modern-			
	powder, c	r boir our		gel, ingleur	ents,	ups nom a	inclent inulan			
	Dantashau	scha- Neem	and	ayanaipa-ve babul sticks		l pulling Te	oth pastes -			
	ingredients	s = mouth way	sh	Jaoui Sucks	, OI	i puiling, it	Jour pastes –			
		s – mouti wa	511.				6 Hours			
	Types of N	Aake un				,	, nours			
	Base $-$ four	ndation – tvn	es – i	ngredients: 1	ipsti	ck-ancient In	dian origin			
	eveliner. m	ascara. eve s	hadov	v, concealers	s, rol	uge.				
	UNIT IV	., - , - ,		,	, .	6	Hours			
	Natural a	nd Synthetic	Perfu	imes		0				
	Indian per	fume Industr	y-atta	rsessentia	ıl oil	s- Medicinal	values of			
	herbal pro	ducts, some	impo	rtant perfun	ne o	il, dhavana	oil, musk,			
	ambrette of	il, champaka	oil and	d oil of vettiv	ver, s	ynthetic – cla	ssification			
	emphasizir	ng characteris	stics –	esters – alco	hols	- aldehydes	– ketones.			
	UNIT V					6	Hours			
	Traditiona	al Beauty tre	eatme	nts						
	Mukhabhy	angam(gentle	e facia	l massage)-	Faci	als - types – a	advantages –			
	disadvanta	ges; face pa	cks –	harmless f	tace	pack formul	ations from			
	ancient Inc	lian origin ty	pes- m	ultani mitti	face	pack, turmer	ic face pack;			
	bleach - ty	pes – advant	ages-	disadvantag	ges;	eyelash tintir	ng; perming-			
	types; nair	colouring an	a aye	ing.						

Recommended Text	 Akanksha Garud, <i>Text Book of Cosmetics</i>, Pragati Educational Publishers, 2012. Sharma B.K., <i>Industrial Chemistry</i>, Goel Publishing House, Meerut, 13th Ed., 2002. Bedi, Tanuja and Vyas, <i>A Handbook of Aromatic and Essential Oil</i> <i>Plants</i>, Agrobios, India, 1st Ed, 2008.
Reference Books	 1.George Howard, Principles and Practice of Perfumery and Cosmetics, Stanley Thornes, Chetltenham, UK 1987. 2.Gaurav Kumar Sharma, Jayesh Gadiya, Meenakshi Dhanawat, Textbook of Cosmetic Formulations, Ist Ed, 2018.
Website and e-learning source	1.http://www.khake.com/page75.htmlNet.foxsm/list/284 2.https://oms.bdu.ac.in/ec/admin/contents/66_P16CHE4B_202006301 0232422.pdf 3. https://tnou.ac.in/wp-content/uploads/2022/12/Beautician- SLM_compressed.pdf 4.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2825132/#:~:text=H air%20dyes%2C%20fragrant%20hair%20rinses,chores%20to%20be% 20religiously%20pursued.

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

- **CO1:** recall the composition of various cosmetic products
- **CO2:** explain chemical aspects and applications of hair care and dental care and skin care products.
- **CO3:** categorize chemical aspects and applications of perfumes and skin care products.
- **CO4:** analyze the methods of beauty treatments, their advantages and disadvantages.
- **CO5:** summarize the hazards of cosmetic products.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	Μ	S	S	S	S	М	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	Μ	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	М	S	S	S	S	S	S	М	S

CO/PO	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

CO-PO Mapping (Course Articulation Matrix)

Level of Correlation between PSO's and CO's

Board of Studies Date : 02.11.2023

Title of the	GENERAL CHEMISTRY – III											
Course					<u> </u>							
Paper No.		₹7) TT	Core Course	e V	G	1					
Category	Core	Y ear Semester		Credits	5	Course Code	23UCHCC3					
Instructional	Lecture	Tutorial	L	ab Practice]	 Fotal					
hours per week	4	1		-			5					
Prerequisites	General Chemistry – I and II											
Objectives of the course	 General Chemistry – I and II This course aims to provide a comprehensive knowledge on the physical properties of gases, liquids, solids and X-ray diffraction of solids. fundamentals of nuclear chemistry and nuclear waste management. applications of nuclear energy basic chemistry of halo-organic compounds, phenol and other aromatic alcohols. preparation and properties of phenols and alcohols. 											
Course	UNIT I						15 Hours					
Outline	Gaseous st Kinetic mo equation; T root mean s equipartitic capacities. of gases. Real gases: compressib equations of temperature isotherms of state–Van of liquefaction	tate lecular model The Maxwell – square and mo on of energy, Collision freque Deviations freque bility factor, Z of states for real e; Numerical p of real gases – der waal's eque n of gases; num	of a gas Boltzma st proba degree Jency; c om ideal (, and it gases problem critical ation an nerical p	: postulates at inn distributio ble velocity a s of freedor ollision diama gas behaviou ts variation v van der Waal s based on e phenomena – d the critical problems invo	nd do n of nd a n an eter; r, (A vith c's eq quat - isol state lving	erivation from speed of mole verage kinetic nd molecular mean free pat andrew's and <i>A</i> pressure for o uation; Virial o ions of states therms of CO ₂ ; law of corres g the core cond	the kinetic gas ecules- average, energy, law of basis of heat th and viscosity Amagat's plots); different gases. equation; Boyle for real gases, 2 - continuity of sponding states- cepts.					
	UNIT-II Liquid and Properties of and amorphis Crystals –s centre and a systems; Bis solids – sin packing; C comparison problems nonstoichio Liquid cry crystals-sm	d Solid State of Liquids- Sur hous – differer m, polymorphi size and shape axis; Miller ind ravais lattices; mple cubic, be co-ordination r n of structure involving cor ometric defects ystals – Mese tectic-nematic-	15 Hours yurface tension, viscosity and their applications. Crystalline rences - geometry, isotropy and anisotropy, melting point; ohism. pe; laws of crystallography; symmetry elements – plane, ndices, unit cells and space lattices; classification of crystal s; X – ray diffraction – Bragg's equation Packing in atomic body centered cubic, face centered and hexagonal close a number in typical structures - NaCl, CsCl, ZnS, TiO ₂ ; re and properties of diamond and graphite; numerical ore concepts Defects in solids - stoichiometric and esomorphic state- Classification of thermotropic liquid ic-cholesteric-disc shaped and polymer liquid crystals-									

UNIT-III

15 Hours

Nuclear Chemistry

•
Natural radioactivity - α , β and γ rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and t ^{1/2} and radioactive series. Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out)
Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.
UNIT-IV 15 Hours
Halogen derivativesAliphatic halogen derivativesNomenclature and classes of alkyl halides – isomerism, physicalproperties, Chemical reactions. Nucleophilic substitution reactions – $S_N 1$, $S_N 2$ and $S_N i$ mechanisms with stereochemical aspects and effect ofsolvent. Di, Tri & Tetra Halogen derivatives: Nomenclature, classification,preparation, properties and applications.Aromatic halogen compoundsNomenclature, preparation, properties and usesMechanism of nucleophilic aromatic substitution – benzvne intermediate
Aryl alkyl halides Nomenclature, benzyl chloride – preparation – preparation properties and uses Alcohols: Nomenclature, classification, preparation, properties, use; conversions – ascent and descent of series; test for hydroxyl groups. Oxidation of diols by periodic acid and lead tetraacetate.
UNIT-V 15 Hours Phenols Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions – Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction.

Resorcinol, quinol, picric acid – preparation, properties and uses.

	Aromatic alcohols
	Nomenclature, benzyl alcohol - methods of preparation - hydrolysis,
	reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis,
	physical properties, reactions - reaction with sodium, phosphorus
	pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide,
	oxidation – substitution on the benzene nucleus, uses.
	Thiols: Nomenclature, structure, preparation and properties.
Extended	Questions related to the above topics, from various competitive
Professional	examinations UPSC/JAM /TNPSC others to be solved
Component (1s	(To be discussed during the Tutorial hours)
a part of	
internal	
component	
only, not to be	
included in the	
external	
question paper)	
Skills acquired	Knowledge Problem solving Analytical ability Professional
from this course	Competency.
	Professional Communication and Transferable skills.
Recommended	1. Puri, B.R, Sharma, L.R. and Pathania, M.S. Principles of
Text	Physical Chemistry, 46 th Ed, Vishal Publishing, 2020.
	2. Puri, B.R. Sharma L.R. and Kalia K.C., Principles of Inorganic
	Chemistry, Milestone Publishers and Distributors, New Delhi, 13th
	Ed, 2009.
	3. Soni P.L. and Mohan Katyal, Textbook of Inorganic Chemistry,
	Sultan Chand & amp; Sons, 20 th , 2006.
	4. Jain, M. K. Sharma S. C, <i>Modern Organic Chemistry</i> , Vishal
	Publishing, 4 th Ed, 2003.
	5. Mukherji, S.M. and Singh S.P., <i>Reaction Mechanism in Organic</i>
Defenence	<i>Chemistry</i> , Macmilian India Lid., 5 st Ed. 1994.
Rooks	Sons 5 th Ed 1992
DUUKS	2 Carey Francis A Organic Chemistry Tata McGraw-Hill Education
	Pyt. Ltd. New Delhi 7 th Ed. 2009.
	3. Finar I. L., Organic Chemistry, Wesley Longman Ltd, England, 6 th
	Ed, 1996.
	4. Soni P. L. and Chawla H. M Text Book of Organic Chemistry,
	New Delhi, Sultan Chand & Sons, 29th Ed 2007.
	5. Lee J.D., Concise Inorganic Chemistry, Blackwell Science, 5th Ed,
	2005.
Website	MOOC components
and e-	https://nptel.ac.in/courses/10410410
learning	$\underline{1}$ Solid state chemistry
source	nttps://npte1.ac.in/courses/1031060/
	$\frac{1}{2}$ industries and safety https://pptol.ac.in/courses/10/10611
	9 Introduction to organic chemistry
	9s Introduction to organic chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain the kinetic properties of gases by using mathematical concepts.

- **CO2:** describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations.
- **CO3:** investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management.
- **CO4:** write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.
- **CO5:** investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.

	PO1	PO2	PO3	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	М	М	М
CO5	S	М	S	S	S	S	S	М	М	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	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

Level of Correlation between PSO's and CO's

Title of the	QUALITATIVE INORGANIC ANALYSIS											
Paper No.		Core (Course-	VI: Core P	Pract	tical-III						
Category	Core	Year Semester	II III	Credits2Course Code23UCH CQ3								
Instructional	Lecture	Tutorial	L	Lab Practice Total								
hours per week	1	-	3 4									
Prerequisites	General c	hemistry										
Objectives of the course	To develo and mixtu	p the skill on the	system	atic analysis	s of s	simple inorg	ganic salts					
Course Outline Skills acquired from this course	 Semi - Micro Qualitative Analysis 1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, iodide, nitrate 2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite. 3. Elimination of interfering acid radicals and identifying the group of basic radicals 4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium 5. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type) Knowledge, Problem solving, Analytical ability, Professional 											
Recommended Text Website and	Reference Venkatesy Principles 2 nd Ed, 19 https://ww	e Books: waran V, Vee of Practical 997. vw.vlab.co.in	eraswam Chemis /broad-a	y R. and Ku try, Sultan C area-chemic	ulanc Chan al-sc	livelu A. R. d & Sons, N ciences	, Basic New Delhi,					
e-learning source												
Course Learning	Outcomes	(for Mappin	g with]	POs and PS	SOs)							
On successful con CO 1: acquire kno CO 2: identify the CO 3: identify the CO 4 : assess the	npletion of t owledge on e cations and cations and role of com	he course the the systematic l anions in the l anions in the non ion effec	student c analys e unkno e soil an ct and so	s should be is of Mixtur wn substand d water and olubility pro	able re of ce. to to duct	to salts. est the quali	ty of water.					

	PO1	PO2	PO3	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	М	М	М

CO-PO Mapping (Course Articulation Matrix)

CO /PO	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
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Subject Code	Subject Name	Category	L	Т	Р	Credits	Inst. Hours	Marks
23UCHGEC3	PHYSICS - I	Generic				3	3	70

COURSE	GENERIC ELECTIVE-I
COURSE TITLE	PHYSICS - I
CODE	23UCHGEC3
CREDITS	3
HOURS	3
COURSE	To impart basic principles of Physics that which would be helpful
OBJECTIVES	for students who have taken programmes other than Physics.

UNITS	COURSE DETAILS
	WAVES, OSCILLATIONS AND ULTRASONICS: simple harmonic
	motion (SHM) – composition of two SHMs at right angles (periods in the ratio
	1:1) - Lissajous figures - uses - laws of transverse vibrations of strings -
	determination of AC frequency using sonometer (steel and brass wires) -
UNII-I	ultrasound – production – piezoelectric method – application of ultrasonics:
	medical field – lithotripsy, ultrasonography – ultrasono imaging- ultrasonics in
	dentistry – physiotheraphy, opthalmology – advantages of noninvasive surgery
	– ultrasonics in green chemistry.
	PROPERTIES OF MATTER: <i>Elasticity</i> : elastic constants – bending of beam –
	theory of non- uniform bending - determination of Young's modulus by non-
	uniform bending - energy stored in a stretched wire - torsion of a wire -
	determination of rigidity modulus by torsional pendulum
UNIT-II	Viscosity: streamline and turbulent motion - critical velocity - coefficient of
	viscosity – Poiseuille's formula – comparison of viscosities – burette method,
	Surface tension: definition - molecular theory - droplets formation-shape, size
	and lifetime – COVID transmission through droplets, saliva – drop weight method
	- Interfacial surface tension.
	nerous plug experiment theory temperature of inversion liquefaction of
	Owner Lindo's process of light factor of an light Owner for medical
LINIT III	Oxygen – Linde's process of inqueraction of an – inquid Oxygen for inedicat
UN11-111	purpose- importance of cryocoolers – thermodynamic system – thermodynamic
	equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency
	– entropy – change of entropy in reversible and irreversible process.
	ELECTRICITY AND MAGNETISM: potentiometer – principle –
UNIT-IV	measurement of thermoemf using potentiometer –magnetic field due to a current
	carrying conductor – Biot-Savart's law – field along the axis of the coil carrying
	current – peak, average and RMS values of ac current and voltage – power factor

	and current values in an AC circuit – types of switches in household and factories–							
	Smart wifi switches- fuses and circuit breakers in houses							
	DIGITAL ELECTRONICS AND DIGITAL INDIA: logic gates, OR, AND,							
	NOT, NAND, NOR, EXOR logic gates – universal building blocks – Boolean							
UNIT-V	algebra - De Morgan's theorem - verification - overview of Government							
	initiatives: software technological parks under MeitY, NIELIT- semiconductor							
	laboratories under Dept. of Space – an introduction to Digital India							
	1. R.Murugesan (2001), Allied Physics, S. Chand & Co, New Delhi.							
	2. Brijlal and N.Subramanyam (1994), Waves and Oscillations, Vikas							
	Publishing House, New Delhi.							
	3. Brijlal and N.Subramaniam (1994), Properties of Matter, S.Chand & Co.,							
TEXT	New Delhi.							
BOOKS	4. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8 th edition),							
	5. Definition of Stranger School & Co. New Delhi							
	6 A Subramaniyam Applied Electronics 2 nd Edn National Publishing Co							
	Chennai.							
	1. Resnick Halliday and Walker (2018). Fundamentals of Physics							
S	(11 th edition),							
OK	2. John Willey and Sons, Asia Pvt. Ltd., Singapore.							
BO	3. V.R.Khanna and R.S.Bedi (1998), Text book of Sound 1 st Edn.							
E	Kedharnaath Publish & Co, Meerut.							
C Z	4. N.S.Khare and S.S.Srivastava (1983), Electricity and Magnetism 10 ^m Edn.,							
XE]	Atma Kam & Sons, New Delni. 5 D.P. Khannaand H.P. Gulati (1070) Optical S. Chand & Co.I.td. New							
	J. D.K.Khaimaand H.K. Gulati (1979). Optics, S. Chand & Co.Ltu., New Delbi							
SEI	6 V.K.Metha (2004) Principles of electronics 6 th Edn S.Chand and							
H	company.							
	1. <u>https://youtu.be/M_5KYncYNyc</u>							
	2. <u>https://youtu.be/ljJLJgIvaHY</u>							
	3. <u>https://youtu.be/7mGqd9HQ_AU</u>							
	4. <u>https://youtu.be/h5jOAW5/OAM</u> 5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/							
WEB	6. http://hyperphysics.phy-							
LINKS	astr.gsu.edu/hbase/permot2.htmlhttps://www.youtube.com/watch?v=gT8Nth9N							
	WPMhttps://www.youtube.com/watch?v=9mXOMzUruMQ&t=1shttps://www.y							
	outube.com/watch'/v=m4u-							
	how-do-they-work							
Board of S	tudies Date : 02.05.2023							

COURSE OUTCOMES:

At the end of the course, the student will be able to:

COURSE OUTCOMES	CO1	Explain types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically. Relate theory with practical applications in medical field.			
	CO2	Explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life. Connect droplet theory with Corona transmission.			
	CO3	Comprehend basic concept of thermodynamics concept of entropy and associated theorems able to interpret the process of flow temperature physics in the background of growth of this technology.			
	CO4	Articulate the knowledge about electric current resistance capacitance in terms of potential electric field and electric correlate the connection between electric field and magnetic field and analyze the mathematically verify circuits and apply the concepts to construct circuits and study them.			
	CO5	Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. Infer operations using Boolean algebra and acquire elementary ideas of IC circuits. Acquire information about various Govt. programs/ institutions in this field.			

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes (CO) for each course with program outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	М	S	S	S	М	S	S	S	S	М
CO3	М	S	S	S	S	М	S	S	S	S
CO4	S	S	S	S	S	S	S	М	S	S
CO5	М	S	S	S	S	S	S	S	S	S

COURSE	GENERIC ELECTIVE –I								
COURSE TITLE	PHYSICS PRACTICAL - I								
CODE	23UCHGECQ1								
CREDITS	2								
HOURS	2								
COURSE OBJECTIVES	Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results								
1 Voung's modu	ANY Seven only								
2. Young's modu	alus by non-uniform bending using optic lever, scale and telescope								
3. Rigidity modu	lus by static torsion method.								
4. Rigidity modu	lus by torsional oscillations without mass								
2. Surface tension	n and interfacial Surface tension – drop weight method								
3. Comparison of	f viscosities of two liquids – burette method								
4. Specific heat c	capacity of a liquid – half time correction								
5. Verification of	f laws of transverse vibrations using sonometer								
6. Calibration of	low range voltmeter using potentiometer								
7. Determination	of thermosemf using potentiometer								
8. Verification of	8. Verification of truth tables of basic logic gates using ICs								
9. Verification of De Morgan's theorems using logic gate ICs.									
10. Use of NAND	10. Use of NAND as universal building block.								
<i>Note</i> : Use of digitation	al balance permitted								
Board of Studies Date : 02.05.2023									

Title of the Course	ENTREPRENEURIAL SKILLS IN CHEMISTRY										
Paper No.	Skill Enhancement Course -IV										
Category	Year II										
	NME	Semester	III	Credits	1	Course Code	23UCHSE C4				
Instructional	Lecture	Tutorial	L	ab Practice	e	r	Total				
hours per week	-	-		1			1				
Prerequisites	General Cl	nemistry									
Objectives of	The course	e aims at prov	iding	training to							
the course	• de	velop entrepre	eneur	skills in stu	dents	S					
	• to	provide hand	ls on e	experience to	o pre	epare and de	velop				
	pr	oducts									
	• de	velop start up	os								
Course Outline	UNIT -I										
	Food Che	mistry									
	Food adult	teration-conta	minat	ion of food	iten	ns with clay	y stones, water				
	and toxic chemicals -Common adulterants.										
	Food additives, Natural and synthetic anti-oxidants, glazing agents										
	(hazardous effect), food colourants, Preservatives, leavening agents,										
	Baking po	wder and bak	ing so	da, yeast, N	15G,	vinegar.					
	Duos										
	Dyes Classificat	ion Natural	ount	natic duas a	nd th	air characta	rictics basic				
	methods a	nd principles	, synu of dye	ieue uyes a	nu ui		fishes – basic				
	memous a	id principies	or uye	ang							
	UNIT II										
	Hands on Experience (Students can choose any four) Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by										
	Preparation	n of Jam. sou	ash an	d Jelly, Gul	kand	l. cottage ch	leese.				
	Preparation	n of produc	ts lik	e candles,	soa	p, detergen	ts, cleaning				
	powder, sh	ampoos, pain	ı balm	, tooth paste	e/pov	vde rand dis	sinfectants in				
	small scale	· · · ·		, I	1						
	Extraction	of oils from s	spices	and flowers	5.						
	Testing of	water sample	s usin	g testing kit	t.						
	Dyeing – c	otton fabrics	with n	atural and s	ynthe	etic dyes					
	Printing –	tie and dye, b	atik.		-	-					
	Identificati	on of Food C	Coloura	ants							
	a) Car	ramel									
	b) Co	chineal									
	c) Tu	rmeric									
	d) An	natto									
	e) Ch	lorophyll									
	f) Bet	anin.									

Skills acquired	Entrepreneurial skills.					
from this course						
Recommended	1. George S & Muralidharan V, (2007) Fibre to Finished Fabric –					
Text	xt A Simple Approach, Publication Division, University of					
	Madras, Chennai.					
	2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.					
	3. Michael Scotter, Food Additives and Contaminants.					
Reference Books	Shyam Jha, Rapid detection of food adulterants and					
	contaminants (Theory and Practice), Elsevier, e Book ISBN					
	9087128004289, 1 st Ed,2015					
Website and	https://www.vlab.co.in/broad-area-chemical-sciences					
e-learning	https://hal.archives-ouvertes.fr/hal-00680179,2012					
source						
Course Learning (Outcomes (for Mapping with POs and PSOs)					
On completion of	the course the students should be able to					
CO 1: identify adul	Iterated food items by doing simple chemical tests.					
CO 2: prepare clear	ning products and become entrepreneurs					
CO 3: educate othe	rs about adulteration and motivate them to become entrepreneurs.					

	PO1	PO2	PO3	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

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
Weightage	6	6	6	6	6
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Title of the Course			PESTIC	IDE CHE	MIS	STRY						
Paper No.		S	Skill Enł	ancement	t Cou	urse -V						
Category		Year	II									
	SEC	Semester	III	Credits	2	Course Code	23UCHSEC5					
Instructional	Lecture	Tutorial	La	b Practice	Practice Total							
hours per week	2	-		-		2						
Prerequisites	Fundame	ntals in chem	istry									
Objectives of	This co	urse aims to p	providing	g the studer	nts	nesticides and their						
the course	 knowledge about the various types of pesticides and their toxicity 											
	toxicity.											
	 to understand the accumulation of pesticides in in the form of residues and its analysis. knowledge on choice of alternate and eco-friendly pesticides. 											
	• knowledge on choice of alternate and eco-friendly pesticides.											
Course	Unit I											
Outline	Introduc	tion: Histor	y of pea	sticides. C	hem	istry of Po	esticides: Brief					
	introduct	ion to classes	of pesti	cides (Che	mica	l class, targ	gets), structures,					
	chemical	names, physi	cal and c	chemical p	rope	rties.						
	Toxicity	of pesticide	s: Acute	and chron	ic to	oxicity in n	nammals, birds,					
	aquatic s	pecies etc. Me	ethods of	analysis o	t pes	sticides.						
	Insectici	des: Classifi	cation at	nd study (of fo	ollowing in	secticides with					
	respect	o structure,	dogradat	in name,	pnys	m formula	tions Mode of					
	action us	s, synulesis,	uegrauai	ion, metal	JOIIS	III, IOIIIIuia	tions, whole of					
	Organon	osphates ar	d Phos	phothionat	es:	Acephate	Chlorpyriphos					
	Monocro	tophos, and	parathio	n-methvl.	Orga	anochlorine	– Endosulfan.					
	heptachlo	or; Carbamate	: Cartap	hydrochlo	ride,	Methomyl,	Propoxur.					
	Unit II		•	2		•	•					
	Pesticide	s residues:	Introd	uction- a	pplic	ation of	agrochemicals,					
	dissemina	ation pathwa	ys of p	esticides,	caus	ses of pest	ticide residues,					
	remedies	. Pesticides re	sidues in	atmospher	re- ei	ntry into atn	nosphere, action					
	of pestici	des, effects of	n enviror	iments. Pes	sticic	les residues	in water - entry					
	into wate	r systems, ac	tion and	effect in a	aquat	tic environr	nent. Pesticides					
	residues i	in soil. entry i	nto soil,	absorption	i, ret	ention and t	ransport in soil,					
	dogradati	on by climati	SIII, SOII	and micro	and I	ertifity, dec	composition and					
	uegrauati	on by chinati	c ractors	and micro	orga							
	Pesticide	Residues ef	fect and	analysis	Effe	cts of pestic	cides residue on					
	human lit	fe, birds and a	nimals-	routes for e	expo	sure to pest	icides, action of					
	pesticide	s on living	system.	Analysis of	of p	esticides re	sidues- sample					
	preparati	on, extractio	on of	pesticides	res	sidues (soi	il, water and					
	vegetable	es/fruits) simp	le metho	ds and sch	eme	s of analysi	s, multi-residue					
	analysis.	-				-						

	Unit III
	Biopesticides: Pheromones, attractants, repellents – Introduction,
	types and application (8- Dodecen-1-ol, 10-cis-12-nexadecadienoic,
	Dimethyl phthalate Icaridin) Baits Metaldebyde Iron (II) phosphate
	Indoxacarb Zinc Phosphide Bromadiolone
Extended	Indoxacaro, Zine Thospinde, Dromadiolone.
Professional	
Component (is	
a part of	
internal	Questions related to the above topics, from various competitive
component	examinations UPSC/ JAM /TNPSC others to be solved
only, not to be	(To be discussed during the Tutorial hours)
included in the	
external	
examination	
question paper)	
Skills acquired	Knowledge, Problem solving, Analytical ability, Professional
from this course	Competency, Professional Communication and Transferable skills.
Recommended	1. Handa S K. Principles of pesticide chemistry. Agrobios (India);
Text	2012.
	2. Matolcsy G, Nádasy M, Andriska V. <i>Pesticide chemistry</i> .
	Elsevier; 1989.
	3. Milyamoto J. and Kearney P. C. Pesticide Chemistry Human Wolfang and the Environment vol. IV. Desticide Desidue and
	Weijare and the Environment vol. IV Pesticide Restaue and Examplation Chamistry Porgomon pross 1085
	A Cremlyn R. Pasticidas, John Wiley
Reference	1 Roy N K Chemistry of Pesticides CBS Publisher & Distributors
Books	P Ltd: 1 st Ed. 2010
200115	2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods of
	pesticide residues analysis. CRC press; 2016.
	3. Ellerbrock R.H., Pesticide Residues: Significance, Management
	and Analysis, 2005
Course Learning	Outcomes (for Mapping with POs and PSOs)
On completion of	the course the students should be able to
CO 1: Identify t	he pesticides and their toxicity with respect to structure and category.
CO 2: explain th	ne preparation and property of pesticides
CO 3: investigat	te the pesticide residues, prevention and care
CO 4: demonstr	ate the extraction and analytical methods of pesticide residues
CO 5: make awa	areness to the public on bio-pesticides

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
C01	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	3.0	3.0	3.0	3.0	3.0
PSOs					

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
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

Level of Correlation between PO's and CO's

Title of the	GENERAL CHEMISTRY-IV											
Donor No												
Category		Voor	п	Core Course -VII								
Category	Core	Somost	11	Credits	5	Course	2311CHCC4					
	Core	er	IV Creatts		5	Code	250011004					
Instructional	Lect	Tutoria	La	b Practice			Total					
nours per		l					5					
Dropoquigitos	Ganara	- 1 Chamiatry	III	-		5						
Chiesting of	This as	I Chemistry			hana	ive Imerulad	lao on					
the course	This co	thormodyno	provic	le a compre	homi	and processes	ige off					
the course	•	aspects		licepts off c	пенн	cal processe	s and applied					
		aspecis. thermochen	nical ca	lculations								
	•	transition el	ements	with refer	ance t	o periodic p	roperties and group					
	•	study of trai	sition	metals		o periodic p	Toperties and group					
	•	the organic	chemis	try of ether	s ald	ehvdes keta	ones and carboxylic					
	•	acids	enemis	uy or euler	5, aiu	enydes, kett	mes and earboxyne					
Course Outline		ucius.		UN	тт							
course outline	Therm	odvnamics	I	UIV			15 Hours					
	Termin	ology – Ir	- ntensive	e extensiv	e pro	operties sta	ate nath functions:					
	isolated	l closed :	and or	en system	o pro	sothermal	adiabatic isobaric					
	isochor	i, closed a	reversi	ble and i	rreve	rsible proce	esses. First law of					
	thermo	dynamics –	Concer	of and signi	fican	ce of heat (a) work (w) internal					
	energy	(F) enthal	nv (H)	calculatio	incan	faw Far	d H for reversible					
	expansi	ion of ideal	79565 III	, carculatio	rmal	onditions r	elation between heat					
	canacit	ies (Cn & C	$v \cdot Iou$	le Thomson	n effe	ect_ inversion	n temperature					
	Thermo	chemistry -	heats o	of reactions	stan	dard states: e	effect of temperature					
	(Kirchł	off's equat	ions) ar	nd pressure	on e	nthalny of re	eactions. Hess's law					
	and its	application	ns: Mea	asurement	of he	eat of reacti	ion –Zeroth law of					
	thermo	dynamics-A	bsolute	e Temperat	ure so	cale.						
		<i>«упипеееееееееееее</i>		UN	TI							
	Therm	odynamics	II				15 Hours					
	Second	Law of the	rmodvn	amics - Li	mitati	ons of first l	aw, spontaneity and					
	random	mess: Carn	ot's cv	cle: Conce	ept o	f entropy.	entropy change for					
	reversil	ble and irre	versible	e processe	s. ent	tropy of mi	xing. calculation of					
	entropy	changes of	an ide	al gas with	chan	iges in temp	erature, volume and					
	pressur	e.		0		0 1	,					
	Free en	ergy and w	ork fur	nctions - N	eed f	or free ener	gy functions, Gibbs					
	free en	ergy, Helm	holtz f	ree energy	- th	eir variation	n with temperature,					
	pressur	e and volun	ne, crite	ria for spor	ntane	ity; Gibbs-H	lelmholtz equation –					
	derivati	ions and a	pplicat	ions; Max	well	relationshi	ps, thermodynamic					
	equatio	ons of state;	Therm	odynamics	of m	ixing of ide	al gases, Ellingham					
	Diagra	m-application	on.	-		-	- 0					
	Third la	aw of therm	odynan	nics - Nern	st hea	at theorem; A	Applications of third					
	law - e	valuation of	f absolu	ite entropie	es fro	m heat capa	acity measurements,					
	excepti	ons to third	law.	-								

UNIT III
General Characteristics of d-block elements 15 Hours
Transition Elements - Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties estably is properties and tendency to form complexes
Gamma states of transition along and new transition along the
Comparative study of transition elements and non-transition elements –
comparison of II and III transition series with I transition series. Group
Study of Thantum, Vanadium, Chronnum, Manganese, Iron, Coball,
UNIT IV
Etners and Epoxides 15 Hours
involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group.
Reactions of epoxides with alcohols, ammonia derivatives and LiAlH ₄ Aldehydes and Ketones
Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes
and ketones; general methods of preparation and physical properties.
Nucleophilic addition reactions, base catalysed reactions with mechanism-
Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation,
Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes.
Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein –
Pondorf Verley reduction, reduction with LiAlH ₄ and NaBH ₄ .
Addition reactions of unsaturated carbonyl compounds: Michael addition.
UNIT V
Carboxylic Acids: 15 Hours
Nomenciature, structure, preparation and reactions of alignatic and
aromatic monocarboxytic acids. Physical properties, acidic nature, effect
Bouveault Blanc reduction, decarboxylation, Huns diecker reaction Formic acid-reducing property.
Carboxylic acid Derivatives: Preparations of aliphatic and aromatic acid
chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, Schottan- Baumann
reaction. Claisen condensation, Dieckmann and Reformatsky reactions,
and Curtius rearrangement.
Active methylene compounds: Keto – enol tautomerism. Preparation and
synthetic applications of diethyl malonate and ethyl acetoacetate
Halogen substituted acids – nomenclature; preparation by direct
halogenation, iodination from unsaturated acids, alkyl malonic acids
Hydroxy acids - nomenclature; preparation from halo, aldehydic and
ketonic acids, ethylene glycol – action of heat on α , β and γ hydroxy acids.

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the tutorial hours).
from this course	Professional Communication and Transferable skills.
Reference Books	 Puri B.R. & Sharma L.R., <i>Principles of Physical Chemistry</i>, Shoban Lal Nagin Chand and Co., 33rd Ed., 1992. Kapoor K. L. <i>A Textbook of Physical chemistry</i>, (volume-2 and 3), Macmillan, India Ltd, 3rd Ed., 2009. Soni P.L. & Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand & Sons, 12th Ed., 2006. Jain M. K. & Sharma S. C. <i>Modern Organic Chemistry</i>, Vishal Publishing, 4th reprint, 2003. Mukherji S.M. & Singh S.P. <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., 3rd Ed., 1994. Maron, S. H. &Prutton C. P. <i>Principles of Physical Chemistry</i>,4th Ed.; The Macmillan Company: Newyork,1972. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4th Ed., ELBS William Heinemann: London,1991. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i>, 10th Ed., Oxford University Press:New York, 2014. Huheey, J. E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, 4th Ed., Addison Wesley Publishing Company: India,1993.
vvebsite and e- learning	1. https://nptel.ac.in/courses/112102255
source	 Thermodynamics <u>https://nptel.ac.in/courses/104101136</u> Advanced transition metal chemistry <u>https://testbook.com/chemistry/aldehydes-ketones</u> <u>https://chem.libretexts.org/Reactions_of_EpoxidesRing-opening</u> <u>https://archive.nptel.ac.in/courses/112/106/112106133/</u>

Course Outcomes

On completion of the course the students should be able to

- **CO1:** explain the terms, processes, first law of thermodynamics and thermochemical calculations.
- **CO2:** discuss the second and third law of thermodynamics and their applications.
- **CO3:** investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.
- **CO4:** discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.
- **CO5:** discuss the chemistry and named reactions related to carboxylic acids and their derivatives, active methylene compounds, halogen substituted acids and hydroxy acids.

	PO 1	P O 2	PO 3	P O 4	Р О 5	P O 6	P O 7	P O 8	PO 9	PO 10
CO 1	S	S	S	S	S	S	S	М	S	S
CO 2	М	S	S	S	М	S	S	М	М	S
CO 3	S	S	S	М	S	S	S	S	S	S
CO 4	S	S	S	S	S	S	S	S	М	S
CO 5	S	М	S	S	S	S	S	S	М	S

CO-PO Mapping (Course Articulation Matrix)

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

CO /PO	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

3 – Strong, 2 – Medium, 1 – Low

Board of Studies Date: 04.11.2024

Title of the	PHYSICAL CHEMISTRY PRACTICAL - I											
Course Depen No	Core Course-VIII: Core Practical-IV											
Category	C	Voar	- V 111. TT									
Category	Core	Semest	I	T Credit 3 Course 23UCHCC								
	core	er	v	S	C	Code						
Instructional	Lectur	Tutori	La	ab Practic	e		Total					
hours per week	e	al		2			2					
Proroquisitos	- General	- Chomistry		3			3					
Objectives of	The cour	chefinsu y	rović	ling an un	ders	tanding of						
the course	• f	be laborato	rvexr	ning an un periments	in o	rder to underst	and the					
	C	concepts of	physi	cal change	es in	chemistry						
	• t	he rates of	chemi	ical reaction	ons	5						
	• c	olligative p	oroper	ties and a	dsor	ption isotherm	i					
Common O d'				TTL		T						
Course Outline	Chomics	lkinotics		UN	11-	1						
	1 Detern	nination of	rate co	onstant of	acid	catalysed hyd	rolysis of an ester					
	(methyl a	acetate (or)	ethvl	acetate).	ueru	cutury see my a						
	2. Deterr	nination of	orde	r of reacti	on t	etween iodide	e and persulphate					
	(initial ra	te method)	•									
	3. Polar	imetry: De	etermi	nation of	rat	e constant of	f acid catalysed					
	inversion	of cane su	gar									
	Thermochemistry											
	4. Deter	mination o	i neat	or neutra	nsat	ion of a strong	, actu by a strong					
	5. Deter	mination o	f heat	of hvdrat	ion d	of copper sulpl	hate					
				J		I I I I I I I I I I I I I I I I I I I						
				UNI	ΤIJ	[
	Electroc	hemistry										
	Conduct	tometry	11									
	6. Detern	nination of	cell c	onstant	Just	ance of strong	alaatralyta					
	7. Detern	nination of	disso	ciation con	nsta	nt of acetic aci	id					
	Potentio	metrv	G 1550	ciution con	insta		u .					
	9. Potent	iometric tit	ration	of HCl ag	gain	st NaOH						
				UNI	гп	T						
	Colligati	ive propert	tv	UN	1 11	1						
	10. Deter	mination o	f mol	ecular wei	ght	of an organic	compound by					
	Rast met	hod using r	naphth	nalene or d	lipho	enyl as solvent	t t					
	11. Deter	rmination o	f mol	ar depress	ion	constant Kf of	the given					
	solvent.											
	Adsorpt	ion	Erre	41: 41 1 1		for the 1	ntion of					
	12. Cons	truction of	Freun	idlich isotl 1	nern	n for the adsor	ption of acetic					
	aciu oli a	cuvated ch	arcoa	1.								
Skills acquired	Knowled	lge, Probler	n solv	ving. Anal	vtica	al ability. Profe	essional					
from this course	Compete	ncy, Profes	siona	l Commu	nicat	tion and Trans	ferable skills.					
		-										

Reference	1. Sindhu, P.S. Practicals in Physical Chemistry, Macmillan									
Books	India : New Delhi, 2005.									
	2. Khosla, B. D.Garg, V. C.; Gulati, A.; Senior Practical									
	Physical Chemistry, R.Chand : New Delhi, 2011.									
	3. Gupta, Renu, Practical Physical Chemistry, 1st Ed.; New Age									
	International: New Delhi, 2017.									
Website and	d https://www.vlab.co.in/broad-area-chemical-sciences									
e-learning										
source										
Course Outcomes	8									
On completion of	the course the students should be able to									
CO1: describe the	principles and methodology for the practical work									
CO2: explain the p	procedure, data and methodology for the practical work.									

CO3: apply the principles of electrochemistry, kinetics for carrying out the practical work.

CO4: demonstrate laboratory skills for safe handling of the equipment and chemicals

	P 01	PO2	PO3	PO4	Р О5	P 06	Р О7	P 08	P 09	PO 10
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	М	S	S	S	М	S	S	S	М	S
CO 3	S	S	S	М	S	S	S	S	S	М
CO 4	S	S	S	S	S	S	S	S	М	М

Level of Correlation between PSO's and CO's

CO /PSO	PS O1	PSO 2	PS O3	PS O4	PSO 5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

Board of Studies Date: 04.11.2024

Subject Code	Subject Name	Category	L	Т	Р	Credits	Inst. Hours	Marks		
23UCHGEC4	PHYSICS –II	Elective - II	2	1	-	3	3	70		
COURSE OBJECTIVES	To understand the basic con Relativity, quantum physics electronics	To understand the basic concepts of optics, modern Physics, Relativity, quantum physics, semiconductor physics and electronics								

UNITS	COURSE DETAILS
	OPTICS: Interference – interference in thin films –colors of thin films –
	air wedge – determination of diameter of a thin wire by air wedge –
UNIT-I	diffraction – diffraction of light– normal incidence – experimental
	determination of wavelength using diffraction grating (no theory) -
	polarization – polarization by double reflection – Brewster's law – optical
	activity – application in sugar industries
	ATOMIC PHYSICS: Atom models – Bohr atom model – mass number
	- atomic number - nucleons - vector atom model - various quantum
UNIT-II	numbers - Pauli's exclusion principle - electronic configuration -
	periodic classification of elements - Bohr magneton - Stark effect -
	Zeeman effect (elementary ideas only).
	NUCLEAR PHYSICS: Nuclear models – magic numbers – shell model
	– nuclear energy – mass defect – binding energy – radioactivity – uses –
	half life - radio isotopes and uses - nuclear fission - energy released in
UINI I-III	fission – chain reaction - atom bomb - nuclear fusion – thermonuclear
	reactions – differences between fission and fusion (elementary ideas
	only).
	INTRODUCTION TO RELATIVITY AND GRAVITATIONAL
	WAVES : Frame of reference – postulates of special theory of relativity
UNIT-IV	– Galilean transformation equations – Lorentz transformation equations
	- derivation - length contraction - time dilation - twin paradox - mass-
	energy equivalence.
	SEMICONDUCTOR PHYSICS: p-n junction diode – forward and
UNIT-V	reverse biasing – characteristic of diode – zener diode – characteristic of
	zener diode – voltage regulator – full wave bridge rectifier.
1	

	1.	R.Murugesan (2005), Allied Physics, S.Chand & Co, New Delhi.
	2.	K.Thangaraj and D.Jayaraman (2004), Allied Physics, Popular Book
		Depot, Chennai.
TEXT BOOKS	3.	Brijlal and N.Subramanyam (2002), Text book of Optics, S.Chand &
		Co, New Delhi.
	4.	R.Murugesan (2005), Modern Physics, S.Chand & Co, New Delhi.
	5.	A.Subramaniyam Applied Electronics, 2 nd Edn., National Publishing
		Co., Chennai.
	1.	Resnick Halliday and Walker (2018), Fundamentals of Physics, 11 th
		Edn., John Willey and Sons, Asia Pvt. Ltd., Singapore.
	2.	D.R.Khanna and H.R. Gulati (1979). Optics, S.Chand & Co.Ltd.,
		New Delhi.
REFERENCE	3.	A.Beiser (1997), Concepts of Modern Physics, Tata Mc Graw Hill
BOOKS		Publication, New Delhi.
	4.	Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal
		Book Stall, New Delhi.
	5.	V.K.Metha (2004), Principles of electronics, 6th Edn., S.Chand and
		Company, New Delhi.
	1.	https://www.berkshire.com/learning-center/delta-p-
		facemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://
		www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U
		<u>&feature=emb_logo</u>
WEBLINKS	2.	https://www.youtube.com/watch?v=JrRrp5F-Qu4
	3.	https://www.validyne.com/blog/leak-test-using-pressure-
		transducers/
	4.	https://www.atoptics.co.uk/atoptics/blsky.htm -
	5.	https://www.metoffice.gov.uk/weather/learn-about/weather/optical-
		ettects
Board of Studies Da	te : C	02.11.2023

COURSE OUTCOMES:

At the end of the course, the student will be able to

	CO1	To understand the concepts of interference, diffraction and polarizations in optics.							
	CO2	To recall the basics of different atom models and various experiments establishing quantum concepts.							
	C03	Fo learn the properties of nuclei, nuclear forces, structure of atominucleus, nuclear models and solve related problems							
COURSE OUTCOMES	03	To a n a l y z e the basic concepts of relativity and							
OUTCOMES	CO4	gravitational waves.							
	CO5	To understand the working of semiconductor devices like junction diode, Zener diode, transistors and full wave bridge rectifier.							

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes (CO) for each course with program outcomes (PO) in the 3-point scale fSTRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	М	S	S	S	М	S	S	S	S	М
CO3	М	S	S	S	S	М	S	S	S	S
CO4	S	S	S	S	S	S	S	М	S	S
CO5	М	S	S	S	S	S	S	S	S	S

Subject Code	Subject Name	Category	L	Т	Р	Credits	Inst. Hours	Marks
23UCHGECQ2	PHYSICS PRACTICAL- II	Elective	-	-	2	2	2	60

COURSE	Elective Course (GE)
COURSE TITLE	PHYSICS PRACTICAL – II
CREDITS	2
COURSE OBJECTIVES	 Apply the concepts of Light, electricity and magnetism and waves, Set up experiments to verify theories, quantify and analyse the observations. To do error analysis and correlate results

Any Eight

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

Board of Studies Date : 02.11.2023

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS							
	S	kill E	nhancemen	t C	Course -VI		
	Year	II					
SEC	Semester	I V	Credits	2	Course Code	23UCHSEC6	
Lectu re	Tutorial	L	ab Practice			Total	
2	-		-			2	
General	Chemistry	1					
The cou	rse aims at pr	ovidi	ng an overal	l vi	iew of the		
• (operation and	troub	leshooting o	of c	hemical instr	uments	
• f	fundamentals	of a	analytical to	ech	iniques and	its	
8	application in	the cl	naracterizati	on	of compound	ls	
• t	heory of chro	matog	graphic sepa	rat	ion and		
• 1	nermo / elect	ro ana	lytical techr	nqu	ues	ma	
• 2	storemometry	anu u		<u>, 10</u>		115	
Oualita	tive and Oua	ntita	tive Aspects	s of	² Analysis	6 Hours	
S.I Unit	s. Distinction	betw	een Mass an	nd V	Weight. Mole	es. Milli moles.	
Milli e	quivalence, I	Molali	ty, Molarit	v,	Normality,	Percentage by	
Weight	and Volume	e, ppn	n, ppb. Der	isit	y and Speci	fic Gravity of	
Liquids						-	
Evaluati	on of analyt	ical d	lata, Errors	_	Types of Er	rors, Accuracy,	
Precisio	n, Minimizat	tion o	f Errors. Si	ign	ificant Figur	es. Methods of	
Express	ing Precision	i: Me	an, Median,	, A	verage Devi	ation, Standard	
Deviatio	DII.		LINIT I	T			
Atomic	Absorption	Snect	UNIT I. rosconv [.]	I		6 Hours	
Basic p	inciples of ir	strum	entation (so	urc	e. monochro	mator. detector.	
choice of	of flame and	Burne	r designs) -	Te	chniques of	atomization and	
sample	introduction-7	Fechn	iques for the	e qu	antitative est	timation of trace	
level of	metal ions fro	om wa	ter samples.				
			UNIT II	Ι			
UV-Vis	ible and IR S	Spectr	oscopy			6 Hours	
Origin o	of spectra, into	eractio	on of radiati	on	with matter,	Beer-Lambert's	
law and	its validity.						
IIV-Vis	ible Spectror	netrv	· Basic princ	inl	es instrumer	ntation for single	
and dou	ble beam inst	rumer	t.	'PI	es, mou amer	indicit for single	
Infrare	d Spectrosco	pv: B	asic principl	es	of instrument	tation for double	
beam in	strument; san	npling	techniques.				
			UNIT I	V			
Therma	al and Electro	o-ana	lytical Metl	nod	ls of Analysi	s 6 Hours	
TGA a	and DTA-	Princi	ple, Instru	me	entation, fac	tors affecting	
TGA/D	IA, Thermal	analys	sis of calcium	m c	oxalates.	of	
and ann	lications	noas:	polarograph	ıy -	principle, in	strumentation	
	INS SEC Lectu re 2 General The cou • f a • t • f a • t • s S Qualita S.I Unit Milli ec Weight Liquids. Evaluati Precisio Express Deviatic Atomic Basic pr choice o sample i level of UV-Vis and dou Infrare beam in Therma TGA a TGA/D	INSTRUMENT SEC Semester Lectu Tutorial 2 - General Chemistry The course aims at pr operation and fundamentals application in theory of chro thermo / elect stoichiometry Qualitative and Qua S.I Units, Distinction Milli equivalence, I Weight and Volume Liquids. Evaluation of analyt Precision, Minimizat Expressing Precision Deviation. Atomic Absorption Basic principles of in choice of flame and sample introduction- level of metal ions free UV-Visible and IR S Origin of spectra, inti law and its validity. UV-Visible Spectror and double beam inst Infrared Spectrosco beam instrument; sam Thermal and Electro TGA and DTA- TGA/DTA, Thermal Electroanalytical metal and applications.	INSTRUMENTAL M Skill En Year II SEC Year II SEC Semester I V Lectu Tutorial L z - General Chemistry The course aims at providin operation and troub application in the cf fundamentals of a application in the cf theory of chromatog thermo / electro ana stoichiometry and the course aims at providing electro ana stoichiometry and the course aims at providing Qualitative and Quantitation in the cf theory of chromatog thermo / electro ana stoichiometry and the course and the course and pulcation in the cf theory of chromatog Units, Distinction betwo Milli equivalence, Molali Weight and Volume, ppn Liquids. Evaluation of analytical do Precision, Minimization o Expressing Precision: Mea Deviation. Atomic Absorption Spectr Basic principles of instrum choice of flame and Burne sample introduction-Techn Ievel of metal ions from wa UV-Visible and IR Spectrometry and double beam instrumer Infrared Spectroscopy: B beam instrument; sampling <th colsp<="" th=""><th>INSTRUMENTAL METHODS Skill Enhancemen Year II SEC Semester I Credits Lectu Tutorial Lab Practice re Tutorial Lab Practice 2 - - General Chemistry The course aims at providing an overal operation and troubleshooting o operation and troubleshooting of fundamentals of analytical to application in the characterizati theory of chromatographic sepa theory of chromatographic sepa thermo / electro analytical techr UNIT-I Qualitative and Quantitative Aspects S.I Units, Distinction between Mass ar Milli equivalence, Molality, Molarit Weight and Volume, ppm, ppb. Der Liquids. Evaluation of analytical data, Errors Stexpressing Precision: Mean, Median, Deviation. UNIT I Atomic Absorption Spectroscopy: Basic principles of instrumentation (so choice of flame and Burner designs) - sample introduction-Techniques for the level of metal ions from water samples UNIT II UV-Visible and IR Spectroscopy: Basic principle data instrument. Infrared Spectroscopy: Basic principle beam instrument; sampling techniques. UVIT IT UNIT II UNIT II UV-Visible Spectrome</th><th>INSTRUMENTAL METHODS OF Skill Enhancement C Vear II SEC Semester I v Credits 2 Lectu Tutorial Lab Practice 2 General Chemistry The course aims at providing an overall vi • operation and troubleshooting of c • fundamentals of analytical tech application in the characterization • theory of chromatographic separat • thermo / electro analytical techniqu • stoichiometry and the related conc UNIT-I Qualitative and Quantitative Aspects of S.I Units, Distinction between Mass and V Milli equivalence, Molality, Molarity, Weight and Volume, ppm, ppb. Densit Liquids. Evaluation of analytical data, Errors – Precision, Minimization of Errors. Sign Expressing Precision: Mean, Median, A Deviation. UNIT II Atomic Absorption Spectroscopy: Basic principles of instrumentation (sourd choice of flame and Burner designs) - Te sample introduction-Techniques for the qu level of metal ions from water samples. UNIT III UV-Visible and IR Spectroscopy Origin of spectra, interaction of radiation law and its validity. UV-Visible Appertorscopy: Basic principles beam instrument; sampling techniques. UNIT IV Thermal and Electro-analytical Method TGA and DTA- Principle, Instrume TGA/DTA, Thermal analysis of calcium of Electroanalytical methods: polarography - and applications.</th><th>INSTRUMENTAL METHODS OF CHEMICA Skill Enhancement Course -VI Vear II SEC Semester V Credits 2 Course Code Lectu re Tutorial Lab Practice 2</th></th>	<th>INSTRUMENTAL METHODS Skill Enhancemen Year II SEC Semester I Credits Lectu Tutorial Lab Practice re Tutorial Lab Practice 2 - - General Chemistry The course aims at providing an overal operation and troubleshooting o operation and troubleshooting of fundamentals of analytical to application in the characterizati theory of chromatographic sepa theory of chromatographic sepa thermo / electro analytical techr UNIT-I Qualitative and Quantitative Aspects S.I Units, Distinction between Mass ar Milli equivalence, Molality, Molarit Weight and Volume, ppm, ppb. Der Liquids. Evaluation of analytical data, Errors Stexpressing Precision: Mean, Median, Deviation. 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	UNIT V
	Separation and purification techniques6 HoursPrinciple of Solvent Extraction and Liquid- Liquid Extraction, Chromatography: Column, TLC, Paper - Principle, Choice of adsorbents, solvents, preparation of Column and elution - development of chromatograms and Rf value.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	 Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman. Gopalan R., Subramanian P. S. and Rengarajan K., <i>Elements</i> of Analytical Chemistry, Sultan Chand, New Delhi, 2007. Skoog, Holler & Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017). Speyer R., <i>Thermal Analysis of Materials</i>, CRC Press, 1993. Day R.A. & Underwood A.L., Quantitative Analysis, 6th Ed., Prentice Hall of India Private Ltd., New Delhi, 1993
Reference Books	 Skoog D. A., West D. M. & Holler F. J., Analytical Chemistry: An Introduction, 5th Ed., Saunders college publishing, Philadelphia, 1998. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004. Mikes, O. & Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London Jeffery G.H., Bassett J., Mendham J. & R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, 6th Ed., Pearson Education, 2000

Website and e-	1	http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-
learning sources	1.	14- final ndf
icui iiiig sources	2	http://eric.ed.gov/?id=EJ386287
	2.	http://www.sisu.edu/faculty/watking/diamag.htm
	J.	http://www.bjsu.cdu/racurty/wakins/dramag.num
	4.	nup.//www.ontainica.com/EDCnecked/topic/1088/5/separatio
	_	<u>n-</u> and-purification
	5.	http://www.chemistry.co.nz/stoichiometry.htm
Course Outcome	S	
On completion of	f the co	urse the students should be able to
CO1: apply error	analysi	s in the calibration and use of analytical instruments.
CO2: explain theo	ory, inst	trumentation and application of flame photometry, atomic
absorption	spectro	metry, UV visible and Infrared spectroscopy.
CO3: able to disc	uss inst	rumentation, theory and applications of thermal and
electrochen	nical te	chniques
CO4 • assess the u	se of cl	promatographic techniques in the senaration and identification of
mixtures	50 01 01	nonacographic cominques in the separation and identification of
CO5. dovelop ski	ll in the	propagation of solutions
CO3. develop ski	II III ule	preparation of solutions.

	P 01	PO2	PO3	PO4	Р О5	P 06	Р О7	P 08	P 09	PO 10
CO 1	S	S	S	S	S	S	S	М	S	М
CO 2	М	S	S	S	М	S	S	М	М	М
CO 3	S	S	S	М	S	S	S	М	S	М
CO 4	S	S	S	S	S	S	S	М	М	М
CO 5	S	М	S	S	S	S	S	М	М	S

Level of Correlation between PSO's and CO's

CO /PSO	PS O1	PS O2	PS O3	PS O4	PSO 5
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

3 – Strong, 2 – Medium, 1 – Low

Board of Studies Date : 04.11.2024

Title of the Course	FORENSIC SCIENCE									
Paper No.	Skill Enhancement Course -VII									
Category		Year	II							
	SEC	Seme ster	IV	Credits	2	Course Code	23UCHSEC7			
Instructional hours per	Lectur e	Tutor ial	L	ab Practic	e	Total				
week	2	-		-			2			
Prerequisites	General (Chemistry								
Objectives of	This cour	rse aims a	t giving	g an overall	viev	w of				
the course	• crime	detection	throug	h analytica	ıl ins	struments				
	• forger	ry and its	detection	on						
	 medic 	cal aspects	s involv	ved						
Course Outline	UNIT IPoisons6 HoursPoisons - types and classification - diagnosis of poisons in the living and the dead -clinical symptoms - Heavy metal contamination (Hg, Pb, Cd) of sea foods - use of neutron activation analysis in detecting arsenic in human hair.									
	UNIT-IICrime Detection6 HoursAccidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP- composition of bullets and detecting powder burns.									
	UNIT-III									
	Forgery and Counterfeiting6 HoursDocuments - different types of forged signatures - writing deliberately modified - uses of ultraviolet rays -comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using AAS to detect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.									
	UNIT-IV									
	Tracks and Traces6 HoursTracks and traces - small tracks and police dogs - foot prints - costing of foot prints - residue prints, walking pattern or tyre marks - miscellaneous traces and tracks - glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - detecting steroid consumption in athletes and raceborses									

	UNIT-V
	Medical Aspects6 HoursMetabolite analysis using mass spectrum - Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics -laboratory examination of barrel washing and detection of powder residue by chemical tests.
Decommonded	1 Japal S A Livin M. Tarthook of formatic chamistry
Tort	1. Iqual S.A, Liviu .M, Texidook of jorensic chemistry, Discovery publishing house private limited 2011
Text	Discovery publishing nouse private infinited, 2011.
	2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC
	Press, Taylor & Francis Group, 2019.
	3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr.,
	Basic principles of Forensic chemistry, Humana Press, 1 st Ed,
	2012.
	4. Bapuly A.K, Forensic Science – Its application in crime
	investigation, Paras Medical Publisher, Hyderabad 2006.
	5. Sharma B.R. Scientific Criminal Investigation, Universal Law
	Publishing Co. Pvt. Ltd, New Delhi 2006.
Reference	1. Richard Saferst in and Criminalistics-An Introduction to Forensic
Books	Science (College Version), Sopfestein, Printice Hall, 8th Ed.
	2. Suzanne Bell, Forensic Chemistry, Pearson, 2 nd international Ed,
	2014.
	3. Jay Siegel, Forensic chemistry: Fundamentals and applications,
	Wiley-Blackwell, first edition, 2015.
	4. Max M. Houck & Jay A. Segal, Fundamentals of Forensic
	Science, Elsevier Academic press 2006.
	5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, Henry Lee's
	Crime Scene Book Elsevier Academic press 2006
Website	1. http://www.library.ucsb.edu/ist/03-spring/internet.html
and e-	
learning	2 http://www.wonder.how.to.com/topic/forensic-science/
source	
Jouree	
Course Outcome	28
On completion of	of the course the students should be able to
CO 1: describe th	e types of poisons and classification of poisons in the living and the
dead organ	nisms.

- **CO 2:** get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal detector devices.
- CO 3: detect the forgery documents, different types of forged signatures
- **CO4:** gain the knowledge in identification and analysis of biological substances blood, saliva, hair etc.,
- **CO 5:** have an exposure on handling fire explodes.

CO-PO Mapping (Course Articulation Matrix)

	Р О 1	P O 2	Р О3	P O 4	PO 5	P O 6	PO 7	PO 8	P O 9	PO 10
CO 1	S	S	S	S	S	S	S	S	S	М
CO 2	М	S	S	S	М	S	S	М	М	М
CO 3	S	S	S	М	S	S	S	М	S	М
CO 4	S	S	S	S	S	S	S	S	М	S
CO 5	S	М	S	S	S	S	S	М	М	S

Level of Correlation between PSO's and CO's

СО /РО	PS O1	PS O2	PS O3	PS O4	PS O5
C01	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

3 – Strong, 2 – Medium, 1 – Low

Board of Studies Date: 04.11.2024