MOTHER TERESA WOMEN'S UNIVERSITYKODAIKANAL –624101

DEPARTMENTOFCHEMISTRY

B.Sc.Chemistry

CurriculumFramework,SyllabusandRegulations

(Based on TANSCHE Syllabus under Choice BasedCredit System-CBCS)

(Forthecandidatesto beadmittedfromtheAcademic Year2023-24)

Mother Teresa Women's University,
KodaikanalDepartmentof Chemistry
Choice Based Credit System
(CBCS)(2023-2024onwards)
B.Sc.Chemistry

1. AbouttheProgramme

TheB.ScChemistryDegreePrograaimstoimpartsoundknowledgeinthefundamentala spectsoftheimportantbranchesofChemistry.Thecurriculumisdesignedtointegratetheoreticala spectswithexperimental/laboratorytechniquesandanalyticalthinking which are incorporated in the core and elective courses to equip the learners withtheskillsrequiredforemployabilityandresearch.Thenon-majorelectivecourses,"Clinicalchemistry" and "Applied chemistry" provide an overview of the important applications ofchemistry to the non-major students. The unique features of the curriculum are ICT basedand management oriented skilled based courses, which equip the learners with the essentialknowledgeofcomputerapplicationsand managerial skills.

2. ProgrammeEducationalObjectives

PEO1	Todevelop broad knowledgeinChemistryinaddition to understandingofkeychemical concepts,principlesandtheories
PEO2	Toemploycriticalthinkingandscientificknowledgetodesign,carryout,recor d and analyzethe resultsofchemicalreactions.
PEO3	Todevelopstudents'abilityandskilltoacquireexpertiseinsolvingboththeoretical and applied chemistryproblems.
PEO4	Toprovideknowledgeandskilltothestudents'thusenablingthemto undertakefurtherstudiesinChemistryrelatedareasor multidisciplinaryareasthat canbehelpfulforself-employment/entrepreneurship.
PEO5	inculcatethescientifictemperament in thestudents.

3. Eligibility

A candidate who has passed the Higher Secondary Examination with Chemistry,Physics and Mathematics/Zoology as core subjects of Tamil Nadu Higher SecondaryBoard or an examination of some other board accepted by Mother Teresa Women'sUniversityshall be eligibleforadmission intoB.Sc.,courseinChemistry.

4. GeneralGuidelinesforUGProgramme

i. **Duration:** The Programme shall extend through a period of 6 consecutive semestersand the duration of a semester shall normally be 90 days or 450 hours. Examinationsshall beconducted attheendofeachsemester fortherespectivesubjects.

ii. **Mediumof Instruction:** English

iii. **Evaluation:** Evaluation of the candidates shall be through Internal Assessment andExternalExamination.

Evaluation Pattern	Theory		Practical	
	Min	Max	Min	Max
Internal	**10**	**25**	**10**	**25**
External	**30**	**75**	**30**	**75**

- **Internal(Theory):Test (15)+ Assignment(5)+Seminar/Quiz(5)=25**
- **ExternalTheory:75**

- **Question Paper Pattern for External examination for all course**

papers.Max.Marks:75 **Time:3 Hrs.**

S.No.	Part	Type	Marks
1	**A**	**10*2Marks=20** MultipleChoiceQuestions (MCQs):2questionsfrom eachUnit	**20**
2	**B**	**5*5=25** Twoquestionsfromeach Unitwith InternalChoice(either/or)	**25**
3	**C**	**3*10=30** Open Choice: Any three questions out of 5 : one question fromeachunit	**30**
*****		TotalMarks	**75**

Minimumcreditsrequiredtopass:156

- **ProjectReport**

A student should carry out and submit the Project Report at the end of the fifthsemester. The Project Report shall not exceed 75 typed pagesin Times New Romanfontwith 1.5 linespace.

- **ProjectEvaluation**

ThereisaVivaVoceExaminationforProjectWork.TheGuideandanExternalExaminer shall evaluate and conduct the Viva Voce Examination.The Project Workcarries100 marks(Internal:25Marks; External(Viva): 75Marks).

5. Conversion of Marks to Grade Points and Letter Grade(Performancein a Course/ Paper)

Rangeof Marks	GradePoints	LetterGrade	Description
90 – 100	9.0 – 10.0	O	Outstanding
80-89	8.0 – 8.9	D+	Excellent
75-79	7.5 – 7.9	D	Distinction
70-74	7.0 – 7.4	A+	VeryGood
60-69	6.0 – 6.9	A	Good
50-59	5.0 – 5.9	B	Average
40-49	4.0 – 4.9	C	Satisfactory
00-39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

6. Attendance

Students must have earned 75% of attendance in each course for appearing for theexamination. Students with 71% to 74% of attendance must apply for condonation in thePrescribed Form with prescribed fee. Students with 65% to 70% of attendance mustapplyfor condonation in the Prescribed Form with the prescribed fee along with the MedicalCertificate. Students with attendance lesser than 65% are not eligible to appear for theexamination and they shall re-do the course with the prior permission of the Head of theDepartment,Principaland the Registrarof theUniversity.

7. MaternityLeave

ThestudentwhoavailsmaternityleavemaybeconsideredtoappearfortheexaminationwitheapprovalofStaffi/c,HeadoftheDepartment,ControllerofExaminationand the Registrar.

8. AnyOtherInformation

In addition to the above-mentioned regulations, any other common regulationspertainingto theUGProgrammers arealsoapplicableforthis Programme.

ProgramOutcomes(POs)

Oncompletion ofthis Programme, thelearnerswillbeableto

PO1	Todevelopbroadknowledgeinchemistryinadditiontounderstandingofkeychemicalconcepts, principlesand theories
PO2	To employ critical thinking and the scientific knowledge to design, carry out,record and analyzetheresults ofchemical reactions.
PO3	Todevelopstudents'abilityandskilltoacquireexpertiseoversolvingboththeoreticalandapplied chemistry problems.
PO4	Toprovideknowledge andskilltothestudents'thusenablingthemto undertakefurtherstudiesinchemistryinrelatedareasormultidisciplinaryareas that can behelpfulforself-employment/entrepreneurship.
PO5	Toinculcate thescientifictemperamentin the students.

ProgramSpecificOutcomes(PSOs)

PSO1	Systematic and coherent understanding of the fundamental concepts inPhysicalchemistry,OrganicChemistry,InorganicChemistry,AnalyticalChemistryand all otherrelatedallied chemistrysubjects.
PSO2	Abilitytousetheevidencebasedcomparativechemistryapproachto explainthechemical synthesisand analysis.
PSO3	Abilitytodemonstratetheexperimentaltechniquesandmethodsoftheirareaofspecialization inChemistry.
PSO4	Developingcriticalthinkingabilitybywayofsolvingproblems/numericalusingBasic chemistryknowledgeandconcepts
PSO5	Understandgoodlaboratorypracticesandsafety.
PSO6	InculcatingahabitoflearningcontinuouslythroughuseofadvancedICTtechniquesandotheravailabletechniques/books/journalsforpersonal academicgrowthaswellas forincreasingemployabilityopportunity.

SYLLABUSFRAMEWWORKFOR B.ScCHEMISTRY

(AsperTANSCHEfrom 2023-24)

SEMESTERI							
Part	CourseCode	CourseTitle	Credit	No. ofHours	CIA	ESE	Tot.Marks
Part-1	U23TAL101/ U23MAL101/ U23FRL101/ U23HIL101	Language – 1: Tamil / Malayalam/French/Hindi	3	6	25	75	100
Part-2	U23ENL101	Language – 2: English	3	6	25	75	100
Part-3	U23CHT101	Core Theory - 1:TheoryGeneralChemistry-I	5	5	25	75	100
	U23CHP102	Core Practical - 2:Practical Organic Analysis and OrganicEstimation	5	5	25	75	100
	U23CHE11A / U23CHE11B	Discipline Specific Elective (Allied) -1: (Allied) A. MathematicsI/ B. Zoology	3	4	25	75	100
Part-4	U23CHS11A / U23CHS11B	Skill Enhancement Course(SEC)– 1: A. Food Chemistry/ B. Role of ChemistryinDailylife	2	2	25	75	100
Part-6	U23CHF101	FoundationCourse	2	2	25	75	100
Total			23	30			

SEMESTERII							
Part	CourseCode	ListofCourses	Credit	No.ofHors	CIA	ESE	Tot.Marks
Part-1	U23TAL202/ U23MAL202/ U23FRL202/ U23HIL202	Language – 1: Tamil / Malayalam/French/Hindi	3	6	25	75	100
Part-2	U23ENL202	Language – 2: English	3	6	25	75	100
Part-3	U23CHT203	Core Theory -3: GeneralChemistry-II	5	5	25	75	100
	U23CHP204	Core Practical – 4: Practical QuantitativeInorganic	5	5	25	75	100

		EstimationandInorganic Preparation					
	U23CHE22A / U23CHE22B	Discipline Specific Elective (Allied) – 2: A. MathematicsII/ B. Zoology Practical	3	4	25	75	100
Part-4	U23CHS202	Skill Enhancement Course -SEC-2 (SoftSkills)	2	2	25	75	100
	U23CHNM21	Naan Mudhalvan Course - 1	2	2	25	75	100
Part-6	U23CHS203	Skill Enhancement Course -SEC-3 Entrepreneurial Skills inChemistry	Additional credit -2		25	75	100
			23	30			

+

SEMESTER – III

Part	Course Code	Course Title	Credit	No. of Hours	CIA	ESE	Total Marks
Part - 1	U23TAL303/ U23MAL303/ U23FRL303/ U23HIL303	Language – 1: Tamil / Malayalam/French/Hindi	3	6	25	75	100
Part - 2	U23ENL303	Language – 2: English	3	6	25	75	100
Part - 3	U23CHT305	Core Theory – 5: General chemistry – III	5	5	25	75	100
	U23CHP306	Core Practical – 6: Qualitative Inorganic Analysis	5	5	25	75	100
	U23CHE33A	Elective-3 Allied (Theory)	3	4	25	75	100
Part - 4	U23CHS304	Skill Enhancement Course (SEC - NME) – 4: Cosmetic Chemistry (Theory)	1	2	25	75	100
	U23CHNM32	Naan Mudhalvan Course - 2	2	2	25	75	100
		TOTAL	22	30			

SEMESTER – IV

Part	Course Code	Course Title	Credit	No. of Hours	CIA	ESE	Total Marks
Part - 1	U23TAL404/ U23MAL404/ U23FRL404/ U23HIL404	Language – 1: Tamil / Malayalam/French/Hindi	3	6	25	75	100

Part - 2	U23ENL404	Language – 2: English	3	6	25	75	100
Part - 3	U23CHT407	Core Theory – 7: Theory General Chemistry – IV	5	5	25	75	100
	U23CHP408	Core Practical – 8: Gravimetric Estimation and Organic Preparation	5	5	25	75	100
	U23CHE44A	Elective (Allied) – 4:	3	3	25	75	100
Part - 4	U23CHS405	Skill Enhancement Course -6 (SEC - NME) -6: Applied Chemistry (Theory)	2	2	25	75	100
	U23CHNM43	Naan Mudhalvan Course - 3	2	2	25	75	100
	U23EVS401	Environmental Science (EVS)	2	2	25	75	100
		TOTAL	25	31			

SEMESTER – V

Part	Course Code	Course Title	Credit	No. of Hours	CIA	ESE	Total Marks
Part – 3	U23CHT509	Core Theory – 9: Organic Chemistry – I	4	5	25	75	100
	U23CHT510	Core Theory – 10: Inorganic Chemistry – I	4	5	25	75	100
	U23CHT511	Core Theory – 11: Physical Chemistry – I	4	5	25	75	100
	U23CHP512	Core Practical – 12: Physical Chemistry Experiments	4	5	25	75	100
	U23CHE55A/ U23CHE55B	Subject Based Elective – 5: A. Spectroscopy and analytical techniques / B. Instrumental methods of chemical analysis	3	3	25	75	100
	U23CHE56A/ U23CHE56B	Subject Based Elective – 6: A. Bio chemistry / B. Pharmaceutical Chemistry	3	3	25	75	100
Part – 4	U23VAE501	Value Education	2	2	25	75	100
	U23CHI501	Internship	2	-	25	75	100
	U23CHNM54	Naan Mudhalvan Course - 4	2	2	25	75	100
		TOTAL	28	30			

Category	Course Code	Course Title	Credit	No. of Hours	CIA	ESE	Total Marks
Part – 3	U23CHT613	Core Theory - 13: Organic Chemistry – II	4	6	25	75	100
	U23CHT614	Core Theory – 14: Physical Chemistry – II	4	6	25	75	100
	U23CHPR61	Core - 10: Project(Group Project)	4	6	25	75	100
	U23CHE67A / U23CHE67B	Subject Based Elective – 7: A. Nano Science and Technology / B. Polymer science	3	5	25	75	100
	U23CHE68A/ U23CHE68B	Subject Based Elective – 8: A. Dairy chemistry / B. Textile Chemistry	3	5	25	75	100
	U23EAS601	Extension Activity	1	-	25	75	100
Part -4	U23CHNM65	Naan Mudhalvan Course - 5	2	2	25	75	100
		TOTAL	**21**	**30**			

SEMESTER – VI

Total credits :142 (minimum credits to pass 142)

Titleofthe Course	**GENERALCHEMISTRY-I**						
PaperNo.	**Core1**						
Category	**Core Theory**	**Year**	I	**Credits**	5	**Course Code**	U23CHT101
		Semester	I				
Instructionalhoursperweek	**Lecture**	**Tutorial**	**LabPractice**			**Total**	
	4	1	-			**5**	
Prerequisites	Highersecondarychemistry						
Objectivesof thecourse	Thecourse aimsat givingan overallviewofthe • Variousatomicmodelsandatomicstructure. • Waveparticledualityofmatter. • Periodic table, periodicity in properties and its application in explaining thechemicalbehavior. • Natureofchemicalbondingandfundamentalconceptsoforganicchemistry.						

CourseOutline	**UNITI** **AtomicstructureandPeriodictrends** History of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomicnumber, Atomic Spectra; Black-Body Radiation and Planck's quantum theory -Bohr'smodelofatom;TheFranck-HertzExperiment;InterpretationofH-spectrum;Photoelectriceffect,Comptoneffect;DualnatureofMatter-De-Brogliewavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle;ElectronicConfigurationof Atomsandions-Hund'srule,Pauli'sexclusionprincipleandAufbauprinciple– Numericalproblemsinvolvingde-Broglie wavelength.

	UNITII **IntroductiontoQuantummechanics** Classicalmechanics,Wavemechanicalmodelofatom,distinctionbetweenaBohrorbitandorbital;Postulatesofquantummechanics;probabilityinterpretationofwavefunctions,DerivationofSchrodingerwaveequation-Probabilityandelectrondensity-visualizing the orbitals -Probability density and significance of Ψ and Ψ2.**ModernPeriodicTable** Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- atomic radii, Ionic, crystal and Covalent radii;ionizationenergy,electronaffinity,electronegativity-electronegativityscales,applicationsof electronegativity.
	UNITIII **Structureandbonding-** **IIonicbond** Lewis dot structure of ionic compounds; properties of ionic compounds; Energyinvolvedinioniccompounds;BornHabercycle–latticeenergies,Madelungconstant;Ionpolarization – polarising power and polarizability; Fajans' rules -effectsof polarisation on propertiesof compounds. **Covalentbond** Shapes of orbitals, overlap of orbitals–σ and Π bonds –hybridization of CH_4, C_2H_4,C_2H_2, ; VSEPR theory - shapes of molecules $BeCl_2$, H_2O, PCl_3, NH_3, CH_4, PCl_5,SF_6. Partialioniccharacterofcovalentbond-dipolemoment,applicationtomoleculesof thetypeA_2,AB,AB_2,AB_3,AB_4percentageioniccharacter.
	UNITIV **Structureandbonding-II** VB theory– application to hydrogen molecule; concept of resonance-resonancestructuresofsomeinorganicspecies–CO_2,NO_2,CO_3^{2-},NO_3^-;limitationsofVBT;MOtheory-bonding,anti-bondingandnon-bondingorbitals,bondorder,MOdiagramsofH_2,C_2,O_2,O^{2-} N_2,CO,NO,HF.Magneticcharacteristics,comparisonofVBand MOtheories. Coordinatebond: Definition,Adduct formationbetween BF_3,NH_3, Metallicbond–electronsea model,VBmodel;Bandtheory-mechanismofconductioninsolids(Briefideaonly);conductors,insulator,semiconductor–types,applicationsof semi-conductors.

	Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipoleinteractions,induceddipoleinteractions,Instantaneousdipole-induceddipoleinteractions. Hydrogen bonding – Intramolecular and intermolecular hydrogenbonding, special properties of water, ice, stability of DNA (Structure of DNA notneeded); Effects ofhydrogen bondingonmelting and boiling points.
	UNITV **BasicconceptsinOrganicChemistryandElectroniceffects** Types of bond cleavage – heterolytic and hemolytic- reagents and substrates-typesofreagents-electrophiles,nucleophiles,freeradicals-reactionintermediates:carbanions,carbo-cations, carbenesandarynes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity ofamines;inductomericand electromericeffects. Resonance–resonanceenergy,conditionsforresonance-acidityofphenols,basicityofaromatic amines,stabilityofcarboniumions,carbanionsandfreeradicals. Hyperconjugation - stability of alkenes, bond length, orienting effect of methylgroup, Typesoforganicreactions-addition,substitution,eliminationandrearrangements.
Recommended Text	1. Madan,R.D.andSathyaPrakash,*ModernInorganicChemistry*,2nded.;S.Chandand Company: NewDelhi, 2003. 2. Puri,B.R.andSharma,L.R.*PrinciplesofPhysicalChemistry*, 38thed.;VishalPublishingCompany:Jalandhar,2002. 3. Bruce,P.Y.andPrasadK.J.R.*EssentialOrganicChemistry*,PearsonEducation:NewDelhi, 2008. 4. A.BahlandB.S.Bahl,AdvancedOrganicChemistry,IMulticolorEdition, S.Chand&Company, NewDelhi,2010. 5.SatyaPrakash,AdvancedInorganic 6. Chemistry, R.D. Madan, Vol I, 5th Edition, S. Chand and Sons, NewDelhi,2012.
ReferenceBooks	1. Maron, S.H. and PruttonC.P.*PrinciplesofPhysicalChemistry*,4thed.; TheMacmillanCompany:Newyork,1972. 2. Lee,J.D. *ConciseInorganicChemistry*,4thed.;ELBSWilliamHeinemann:London, 1991. 3. Gurudeep Raj,*AdvancedInorganicChemistry*,26thed.;GoelPublishingHouse:Meerut, 2001. 4. Atkins,P.W.&Paula,J.*PhysicalChemistry*,10thed.;Oxford University Press:NewYork,2014. 5. Huheey,J.E. *Inorganic Chemistry: Principles of Structure and Reactivity*,4thed.;Addison,Wesley PublishingCompany:India,1993.

CourseLearningOutcomes(forMappingwithPosandPSOs) **On completion of the course the students should beableto**
CO1Explaintheatomicstructure,waveparticle,dualityofmatter,periodicpropertiesbonding,and propertiesof compounds.
CO2 Classifytheelementsintheperiodictable,typesofbonds,reactionsintermediateelectronic effects inorganic compounds,typesofreagents.
CO3Applythetheoriesofatomicstructures,bonding,tocalculateenergyofspectral, transitions,Δx,Δpelectrongravity,percentageioniccharacterandbondorder.
CO4Evaluatetherelationsexistingbetweenelectronicconfiguration,bonding,geometryofmolecules andreactions; structureactivityandelectroniceffects.
CO5 Construct MO diagrams, predict trends in periodic properties, assess the propertiesof elements, and explain hybridization in molecules, nature of H – bonding andorganicreaction mechanisms.

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**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
Weightedpercentage ofCourseContributiontoPos	3.0	3.0	3.0	3.0	3.0

LevelofCorrelationbetweenPSO'sandCO's

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

<table>
<tr><td>Title ofthe Course</td><td colspan="6">ORGANICANALYSISANDORGANICESTIMATION</td></tr>
<tr><td>Paper No.</td><td colspan="6">Core 2</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CorePractical</td><td>Year</td><td>I</td><td>Credits 5</td><td>Course Code</td><td rowspan="2">U23CHP102</td></tr>
<tr><td>Semester</td><td>I</td><td></td><td></td></tr>
<tr><td>Instructional Hours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td>LabPractice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>-</td><td colspan="2">-</td><td>5</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="6"></td></tr>
<tr><td>Objectives ofthecourse</td><td colspan="6">Thiscourseaimsatprovidingknowledgeon
• laboratorysafety
• handlingglassware
• analysisoforganiccompounds
• organicestimation</td></tr>
<tr><td>CourseOutline</td><td colspan="6">UNITI
Safetyrules,symbolsandfirstaidinchemistrylaboratory
BasicideasaboutBunsenburner,itsoperationandpartsoftheflame.Chemistry laboratoryglassware–basicinformationanduses.</td></tr>
<tr><td></td><td colspan="6">Unit II
QualitativeOrganicAnalysis
Preliminaryexamination,detectionofspecial elements-nitrogen,Sulphurandhalogens
Aromaticandaliphaticnature,Testforsaturationandunsaturation,identificationof functional groups using solubility tests.Confirmationoffunctionalgroups
• monocarboxylicacid,dicarboxylicacid
• monohydricphenol
• aldehyde,ketone, ester
• carbohydrate(reducingandnon-reducingsugars)
• primaryamine
• monoamide,diamide.
• anilide,nitrocompound
• Preparationofderivativesforfunctionalgroups</td></tr>
<tr><td></td><td colspan="6">UNITIII
OrganicEstimation
a. Estimationofaniline
b. Estimationofphenol</td></tr>
</table>

Referenc eBooks	1. Venkateswaran,V.; Veeraswamy, R.; Kulandaivelu, A.R. *Basic Principlesof Practical Chemistry*, 2nded.; Sultan Chand: NewDelhi,2012. 2. Manna,A.K. *Practical Organic Chemistry*, Books and Allied: India,2018. 3. Gurtu,J.N;Kapoor,R. *Advanced Experimental Chemistry (Organic)*,SultanChand:NewDelhi,1987. 4. Furniss,B.S.;Hannaford,A.J.;Smith,P.W.G.;Tatchell,A.R.*Vogel'sTex tbook of PracticalOrganicChemistry*, 5thed.; Pearson:India,1989.
Website ande-learning Source	https://www.vlab.co.in/broad-area-chemical-sciences

CO1 Estimatethe amountofan organic compoundin eachsolution.
CO2 Identifythepresenceofspecialelementsandfunctionalgroupinanunknownorganiccompou ndperforming systematic analysis.
CO3 Compare mono and dicarboxylicacids, mono and diamides, mono and polyhydricphenols,aldehydeandketone,reducing&non-reducingsugarsandexplainthereactions behindit.
CO4 Exhibita solidderivativewithrespect tothe identifiedfunctional group.

CO-POMapping(CourseArticulationMatrix)

CO/PO	PSO 1	PSO 2	PSO 3	PSO4	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
Weightedpercentageof CourseContribution toPos	3.0	3.0	3.0	3.0	3.0

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

Titleofthe Course	FUNDAMENTALSOFCHEMISTRY						
PaperNo.	Elective1						
Category	Allied Theory	Year	I	Credits	3	Course Code	U23CHE11
		Semester	I				
Instructional hoursper week	Lecture	Tutorial	LabPractice			Total	
	3	1	-			4	

Objectives

1. Tounderstandthe handlingof chemicalsand errorsinchemicalanalysis
2. Togetknowledgeinchemicalbondingandhybridization
3. Toacquireknowledgeinvolumetricanalysis
4. TounderstandthebasicconceptofchemistryofThermodynamicsandKinetics

UNITI

HandlingofChemicalsandDataAnalysis

a) Storageandhandlingofchemicals:Handlingofacids,ethers,toxicandpoisonouschemicals.Antidotes,thresholdvapourconcentration and first-aid procedure.

b) Errors in chemical analysis: Accuracy, precision. Types of error- absolute and relative errors. Methodsofeliminating and minimizing errors.

c) Separationtechniques–

Solventextraction.Principleofadsorptionandpartitionchromatography,columnchromatography,thinlayerchromatography(TLC),paperchromatographyandtheirapplications.**UNIT II**

ChemicalBonding

a) IonicBond:NatureofIonicbond.StructureofNaCl,KClandCsCl.Factorsinfluencingtheformationof ionicbond.

b) CovalentBond: Natureofcovalent bond. Structureof CH_4, NH_3, H_2Obased on hybridization.

c) Coordinate Bond: Nature of coordinate bond. Coordination complexes.

Werner'stheory.Geometricalandopticalisomerisminsquareplanarandoctahedralcomplexes.

Mentionofstructureandfunctionsofchlorophyllandhemoglobin

d) Hydrogen Bond: Theory and importance of hydrogen bonding. Types of hydrogenbonding.Hydrogenbondingincarboxylicacids,

alcohol,amides,polyamides,DNAandRNA.

e) vanderWaal's forces:Dipole –dipoleanddipole -induced dipoleinteractions.

UNITIII

VolumetricAnalysis

a) Methodsofexpressingconcentration:normality,molarity, molality,ppm.

b) Primaryandsecondarystandards:preparationof standardsolutionsc)Principleofvolumetric analysis:endpointandequivalencepoints.

d)Strongandweakacidsandbases - Ionicproductofwater,pH,pKa,pKb. Buffersolutions- pHofbuffersolutions. Mention of Hendersonequation& its significance.

UNITIVKin etics

a) Chemical Kinetics: Rate, rate law, order and molecularity. Derivation of rate expressionsforIandIIorder reactions.

b) Catalysis- Homogeneousandheterogeneouscatalysis.Enzymecatalysis,enzymesinbiologicalsyst em and in industry.

UNIT VThermodynamics

a) Introduction: Scope and importance of thermodynamics- system and surrounding-isolated, closed andopen systems- state of the system- intensive and extensive variables. Thermodynamic process- reversibleandirreversible, isothermal and adiabaticprocess-

b) First law of thermodynamics- statement- definition of internal energy (E),enthalpy (H), applications offirstlaw ofthermodynamics.

The second law of thermodynamics: Limitations of first law and the need for the second law, differentwaysof statingIIlawand its significance, Spontaneous orirreversible process.

Theconceptof entropy–definition andphysical significanceofentropy.

TextBooks:

1. A.BahlandB.S.Bahl,AdvancedOrganicChemistry,IMulticolorEdition,S.Chand&Company,NewDelhi,2010.

2.SatyaPrakash,AdvancedInorganicChemistry,R.D.Madan,VolI,5th Edition,S.ChandandSons,NewDelhi,2012.

3.B.R.Puri, L.R.Sharmaand M.S.Pathania,Principles ofPhysical Chemistry,46th Edision, Vishal

PublishingCompany,NewDelhi,2013.

ReferenceBook:

1.1.R.Gopalan,S.Sundaram,*AlliedChemistry*,SultanChandandSons,1995.

CO	Courseoutcomes	Remarks
CO1	Studentscangaintheknowledgeonthehandlingofchemicalsand errorsinchemicalanalysis.	K2,K3
CO2	LearnChemicalBondingandHybridization	K2
CO3	Learnthecalculationsof preparingstandardsolutions	K2,K3
CO4	Understandandappreciatetheadvancedconcepts andrateequations inchemicalkinetics.	K2
CO5	Calculatechangeinthermodynamicproperties, equilibrium constants,partialmolarquantities,chemicalpotential	K2

K1-Remember **K2**-Understand **K3**-Apply **K4**-Analyze**K5**-Evaluate

Mappingof Coswith POs&PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	M	M	M	S	S	S	S
CO2	S	S	S	S	M	M	S	S	S	S
CO3	S	S	S	S	M	M	S	M	S	S
CO4	S	S	S	S	M	M	S	S	S	S
CO5	S	S	S	M	M	M	S	S	S	S

StronglyCorrelating(S) -3marks
ModeratelyCorrelating(M) -2marks
WeaklyCorrelating(W) -1mark
NoCorrelation (N) -0mark

<table>
<tr><td>Titleofthe Course</td><td colspan="8">FOODCHEMISTRY</td></tr>
<tr><td>PaperNo.</td><td colspan="8">SEC-1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC Theory</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td><td colspan="2">U23CHS11A</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hoursperweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">LabPractice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td></td><td colspan="3">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Highersecondarychemistry</td></tr>
<tr><td>Objectives of thecourse</td><td colspan="8">Thiscourseaimsatgivinganoverall viewofthe
• Typesoffood
• Foodadulterationandpoisons
• Foodadditivesandpreservation</td></tr>
<tr><td>CourseOutline</td><td colspan="8">UNIT I:FoodAdulteration
Foodadulteration-contaminationofwheat,rice,milk,butteretc.withclaystones,waterandtoxicchemicalsCommonadulterants,Gheeadulterantsandtheirdetection.</td></tr>
<tr><td></td><td colspan="8">UNITII: FoodPoison
Foodpoisons-naturalpoisons(alkaloids-nephrotoxin)pesticides,(DDT,BHC,Malathion)-Chemical poisons–Firstaidforpoison consumedvictims.</td></tr>
<tr><td></td><td colspan="8">UNITIII:FoodAdditives
Food additives-artificial sweeteners–Saccharin-Cyclomate and Aspartate Food flavours-someexamples–Foodcolours–Emulsifyingagents–preservativesleaveningagents.
Bakingpowder–yeast–tastemakers–MSG-vinegar.</td></tr>
<tr><td></td><td colspan="8">UNIT-IV:Beverages
Beverages-soft drinks-soda-fruit juices-alcoholic beverages-examples.
Carbonation-addictionto alcohol–diseases ofliverandsocialproblems.</td></tr>
<tr><td></td><td colspan="8">UNIT-V:EdibleOils
Fatsandoils-Sourcesofoils-productionofrefinedvegetableoils-preservation.Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventingheart diseases.</td></tr>
<tr><td></td><td colspan="8">1. Foodchemistry,H.K.Chopra,P.S.Panesar,Narosapublishinghouse,2010.
2. AtextbookofpharmaceuticalchemistrybyJayashreeGhosh,SChandpublishing,2012.
3. S.Vaithyanathan, Text book of Ancillary Chemistry; PriyaPublications,Karur,2006.
4.B.K,Sharma,IndustrialChemistry;GOELpublishinghouse,Meerut,sixteenthedition,2014.
5. Introductiontoforensicchemistry,KellyM.Elkins,CRCPressTaylor&FrancisGroup, 2019.
6.JayashreeGhosh,FundamentalConceptsofAppliedChemistry,S.</td></tr>
</table>

	Chand&Co.Publishers,second edition,2006.

ReferenceBooks	1.Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill,Texas,fourth edition, 1977. 2.W.A.Poucher, Joseph A. Brink, Jr. Perfumes, Cosmetics and Soaps, Springer,2000. 3.A.K. De,EnvironmentalChemistry, NewAge International PublicCo.,1990.
Web siteand e-learningsource	

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

CourseLearningOutcomes (for Mapping with POs and PSOs)Oncompletionof thecourse thestudentsshould beableto

CO1 LearnaboutFoodadulteration-contaminationofWheat,Rice,Milk,Butter.
CO2 Get an awareness about food poisons like natural poisons(alkaloids-nephrotoxin)pesticides,DDT,BHC,Malathion
CO3 GetanexposureonfoodadditivesartificialsweeteneersSaccharinCyclomateandAspartateinthefoodindustries.

CO4 Acquireknowledgeonbeverages,softdrinks,soda,fruitjuicesandalcoholicbeveragesexamples.
CO5Studyaboutfatsandoils-Sourcesofoils-productionofrefinedvegetableoils-preservation.Saturatedandunsaturatedfats–MUFAand PUFA

<table>
<tr><td>Titleofthe Course</td><td colspan="8">ROLEOFCHEMISTRYINDAILYLIFE</td></tr>
<tr><td>PaperNo.</td><td colspan="8">SEC-1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC Theory</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">U23CHS11B</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hoursper week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="3">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td colspan="2"></td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Highersecondarychemistry</td></tr>
<tr><td>Objectives of thecourse</td><td colspan="8">This courseaimsat providing anoverallviewofthe
• ImportanceofChemistryineverydaylife
• Chemistryofbuildingmaterialsandfood
• ChemistryofDrugsandpharmaceuticals</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">UNITI
General survey of chemicals used in everyday life. Air- components and theirimportance; photosynthetic reaction, green - house effect and the impact on ourlifestyle.Water-Sourcesofwater,qualitiesofpotablewater,softandhardwater.</td></tr>
<tr><td colspan="8">UNITII
Buildingmaterials-cement,ceramics,glassandrefractories-definition,composition and application only. Uses of Plasticspolythene,PVC, bakelite,polyesters,melamine-formaldehyderesins.</td></tr>
<tr><td colspan="8">UNITIII
FoodandNutrition-Carbohydrates,Proteins,Fats-definitionandtheirimportanceas food constituents– balanced diet–Calories minerals and vitamins (sources andtheirphysiologicalimportance).</td></tr>
<tr><td colspan="8">UNITIV
Chemicalsinfoodproduction–fertilizers-need,naturalsources;urea,NPKfertilizers and super phosphate. Fuel – classification - solid, liquid and gaseous;nuclearfuelexamples anduses.</td></tr>
<tr><td colspan="8">UNITV
Pharmaceuticaldrugs-analgesicsandantipyretics-paracetamolandaspirin.pigmentsand dyes-examplesand applications.</td></tr>
</table>

RecommendedText	1. Foodchemistry,H.K.Chopra,P.S.Panesar,Narosapublishinghouse,2010. 2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, SChandpublishing,2012. 3. S.Vaithyanathan, Text book of Ancillary Chemistry; PriyaPublications,Karur,2006. 4.B.K,Sharma,Industrial Chemistry; GOEL publishinghouse,Meerut,sixteenthedition,2014. 5. Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor& FrancisGroup, 2019. 6. JayashreeGhosh,FundamentalConceptsofAppliedChemistry,S.Chand&Co .Publishers, second edition,2006.
ReferenceBooks	1.Randolph.NorrisShreve,ChemicalProcessIndustries,McGraw-Hill,Texas,fourthedition, 1977. 2.W.A.Poucher, Joseph A.Brink, Jr. Perfumes,Cosmetics andSoaps,Springer,2000. 3.A.K. De,EnvironmentalChemistry, NewAge InternationalPublicCo.,1990.
Website and e-learningsource	

CourseLearningOutcomes (forMappingwithPosandPSOs)On completionof thecourse

Course Learning Outcomes (for Mapping with Pos and PSOs)On completion of the courseCO1: Learnaboutthechemicalsusedineverydaylifeaswellasairpollutionandwaterpollution.
CO2: Get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC bakelite,polyesters,
CO3: Acquire information about Food and Nutrition. Carbohydrates, Proteins,FatsAlsohaveanawarenessabout CosmeticsToothpastes,facepowder,soapsanddetergents.
CO4: Discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid,liquidand gaseous;nuclearfuel-examples anduses
CO5: Have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin andalso aboutpigmentsand dyesanditsapplications

CO-POMapping(CourseArticulationMatrix)

CO/PO	PSO 1	PSO 2	PSO3	PSO 4	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
Weightedpercentageof CourseContributionto Pos	3.0	3.0	3.0	3.0	3.0

LevelofCorrelationbetweenPSO'sandCO's

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

<table>
<tr><td>Titleofthe Course</td><td colspan="8">FOUNDATIONCOURSE</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Foundatio nCourse</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">U23CHF101</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td>Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Highersecondarychemistry</td></tr>
<tr><td>Objectivesof thecourse</td><td colspan="8">Thiscourseaims at providingan overallviewof
• Creatinginterestandconfidenceinchemistry.
• Understandingthefundamentalconcepts.
• Knowingtheimpactofchemistryinlife.</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="8">UNITI
RemarkableDiscoveriesandInventions
MajorContributionsofScheele,Lavoisier,HenryBecquerel,MaryCurie,Fried richWöhler,MichaelFaraday,WilliamHenryPerkin,Ramsay,Sir.C.V.Raman, Haber, Alexander Fleming, Hans Van Pechmann (Only brief ideaforeach)- Useof MRIscanning, Dialysisin bloodpurification.</td></tr>
<tr><td colspan="8">UNITII
Laboratoryhygieneandsafety
Reactive inorganic substances and their toxicity (strong acids, bases, halogens,chromates). Hazards due to chemicals, toxic solids, liquids, gases, and otherharmfulsubstances-carcinogenicsubstances.Emergencyproceduresinchemicalsplashes to skin and eyes, burns and electric shock. Introduction to lab safety-regulatory requirements-labels, material safety- MSDS. Knowledge of hazardwarninginformation and symbols.</td></tr>
<tr><td colspan="8">UNITIII
Principlesofvolumetricanalysis
Moles, equivalent weights, Molality, Molarity, Normality, Percentage by Weightand Volume, ppm, - principle of volumetric analysis – primary and secondarystandards.</td></tr>
<tr><td colspan="8">UNITIV
PrinciplesofQualitativeAnalysis
Inorganicqualitativeanalysis–
Commonioneffectandsolubilityproductandtheirapplication inthe precipitationofcations inamixture.</td></tr>
</table>

	UNITV **ImpactofChemistryinhumanlife** Everyday consumer items - Food preservatives, anti-oxidants, (brief idea only) - handmade soaps, shampoo, antiseptics, hair oils, and moisturizer (brief ideaonly) - Farmyard manure, Compost- Gaseous fuels at home– Glass fibrereinforcedplasticsandcarbon FibreReinforcedPlastics–examples.

Recommended Text	1. ElementsofAnalyticalChemistrybyGopalanSubramanianP.S.GopalanR.,Rangarajan K.SultanChand,2003. 2. Foodchemistry,H.K.Chopra,P.S.Panesar,Narosapublishinghouse,2010. 3. S. Vaithyanathan, Textbook of Ancillary Chemistry; PriyaPublications,Karur,2006. 4.B.K,Sharma,Industrial Chemistry; GOEL publishinghouse,Meerut,sixteenthedition,2014. 5.Introductiontoforensicchemistry,KellyM.Elkins,CRCPressTaylor&FrancisGroup,2019.
ReferenceBooks	1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic PrinciplesofPracticalChemistry,2nded.;SultanChand:NewDelhi,2012. 2. Mendham,J.;Denney,R.C.;Barnes,J.D.;Thomas,M.;Sivasankar,B.;Vogel'sTextbookofQuantitativeChemicalAnalysis,6th ed.;PearsonEducation Ltd: NewDelhi, 2000.
Websiteande-learningsource	1. Timelineofchemistry–Wikipedia. 2. https://www.chemir.com/

Course Learning Out comes (for Mapping with POs and PSOs)Oncompletionofthecoursethestudentsshouldbeableto

CO1: Appreciatetheevolutionofchemistryandthechemistswhocontributedforchemistry.
CO2: Demonstratethelabsafety-regulatory requirements,proceduresinchemicalsplashes. **CO3:** Explain theprinciplesofvolumetricanalysis.
CO4: Discusstheprinciplesofqualitativeanalysis.

CO5: Appreciatetheimpactofchemistryinhumanlife.

LevelofCorrelationbetweenPSO'sandCO's

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

CO-POMapping(CourseArticulationMatrix)

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
WeightedpercentageofCourseContributionto Pos	3.0	3.0	3.0	3.0	3.0

SEMESTERII

<table>
<tr><td>Title ofthe Course</td><td colspan="7">GENERALCHEMISTRY-II</td></tr>
<tr><td>Paper no.</td><td colspan="7">Core3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Theory</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">U23CHT202</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">GeneralChemistryI</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">This courseaimsatprovidinganoverallviewofthe
• chemistryofacids,basesandionicequilibrium
• propertiesofsandp-blockelements
• chemistryofhydrocarbons
• applicationsofacidsandbases
• compoundsofmainblockelementsandhydrocarbons</td></tr>
<tr><td>CourseOutline</td><td colspan="7">UNITI
Acids,basesandIonicequilibria
ConceptsofAcidsandBases-Arrheniusconcept,Bronsted-Lowryconcept, Lewisconcept;Relativestrengthsofacids,basesanddissociationconstant;dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions;Degreeofdissociation,commonioneffect,factorsaffectingdegreeofdissociation;acidbaseindicators,theoryofacidbaseindicators– actionofphenolphthaleinandmethylorange,titration curves-useof acidbase indicators;
Buffer solutions – types, mechanism of buffer action in acid and basic buffer,Henderson-Hasselbalchequation.

Salthydrolysis-
saltsofweakacidsandstrongbases,weakbasesandstrongacids,weakacidsandweakbases-
hydrolysisconstant,degreeofhydrolysisandrelationbetweenhydrolysis constantanddegree of hydrolysis.
Solubilityproduct-determinationandapplications.
Numericalproblemsinvolvingthedegreeofhydrolysisandsolubilityproduct.</td></tr>
<tr><td></td><td colspan="7">UNITII
Chemistryofs- BlockElements
Hydrogen:Positionofhydrogenintheperiodictable.Alkalimetals: Comparativestudy of the elements with respect to oxides, hydroxides, halides, carbonates andbicarbonates. Diagonal relationship of Li with Mg. Preparation, properties anduses of NaOH, Na_2CO_3, $KClO_3$- Alkaline earth metals-General group discussion.
Chemistryof p-Block Elements(Group 13& 14)
Preparation and structure of diborane and borazine. Chemistry of borax.Extractionof Alanditsuses. Alloys of Al.
Comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties,structureand uses. Structureand uses of percarbonates.</td></tr>
</table>

	UNITIII **Chemistryofp-BlockElements(Group15-18)** General characteristics of elements of Group15; chemistry of H_2N-NH_2, HN_3 andHNO_3.Chemistryof oxy acids ofphosphorous($H_3PO_3$and H_3PO_4). General properties of elements of group16-Structure and allotropy of elements –Preparation, properties and structure of ozone- Classification of oxides – Oxyacidsofsulphur(Caro's and Marshall'sacids). Chemistry of Halogens: General characteristics of halogen with reference toelectro-negativity,electronaffinity,oxidationstatesandoxidizingpower.Peculiarities of fluorine.Comparative study of halogen acids (HF, HCl, HBr andHI). Uses of $HClO_4$.Basic concepts of Inter-halogen compounds- Structure ofICl,ClF_3, $BrF_5$and IF_7-Basicnature of Iodine. Noblegases: Positionintheperiodictable. StructureofXeF2,XeF4,XeF6andXeOF4;usesofnoblegases-clathratecompounds.
	UNITIV **HydrocarbonChemistry-I** **Petroproducts**: Fractional distillation of petroleum; cracking, isomerisation,alkylation,reforming and uses. **Alkenes**-Nomenclature,generalmethodsofpreparation–Mechanismofß-eliminationreactions–E1andE2mechanism-HofmannandSaytzeffrules.Reactionsofalkenes–additionreactions–Markownikoff'srule,Kharascheffect,oxidation reactions – hydroxylation,oxidative degradation, epoxidation,ozonolysis,polymerization. **Alkadienes** Nomenclature-classification–isolated,conjugatedandcumulateddienes–Diels–Alderreactions. **Alkynes** Nomenclature;generalmethodsofpreparation,propertiesandreactions;acidicnatureof terminalalkynesand acetylene. **Cycloalkanes**:Nomenclature,Relativestabilityofcycloalkanes,Bayer'sstraintheoryand itslimitations.

	UNITV **HydrocarbonChemistry-II** **Benzene:**Source,structureofbenzene,stabilityofbenzenering,molecularorbitalpictureofbenzene,aromaticity,Huckel's(4n+2)ruleanditsapplications.Generalmechanismofaromaticelectrophilicsubstitution-nitration,sulphonation,halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstitutedbenzene-Effectof substituent–orientationand reactivity. **Polynuclear Aromatic hydrocarbons**: Naphthalene – nomenclature, Haworthsynthesis- reactions–preferential substitution at ß -position–reduction, oxidation–uses.
Extended	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminations
Professional	UPSC/JAM/TNPSCothersto besolved
Component(is a	(TobediscussedduringtheTutorialhours)
Partofinternal	
component only,Not to be includedin the externalexamination questionpaper)	
Skillsacquired Fromthiscourse	Knowledge,Problemsolving,Analyticalability,ProfessionalCompetency, ProfessionalCommunicationandTransferableskills.
Recommended Text	1. MadanRD,SathyaPrakash,(2003),ModernInorganicChemistry,2nded,S.Chand andCompany, NewDelhi. 2. SathyaPrakash,TuliGD,BasuSKandMadanRD,(2003),AdvancedInorganicChemistry,17thed.,S.Chand andCompany, New Delhi. 3. BahlBS,ArulBhal,(2003),AdvancedOrganicChemistry,3rded.,S.Chand andCompany,New Delhi. 4. TewariKS,MehrothraSNandVishnoiNK,(1998),TextbookofOrganicChemistry,2nded.,Vikas PublishingHouse, NewDelhi. 5. PuriBR,SharmaLR,(2002),Principlesof Physical Chemistry,38thed.,Vishal PublishingCompany, Jalandhar.
ReferenceBooks	1. MaronSHandPruttonCP,(1972), PrinciplesofPhysical Chemistry,4thed.,TheMacmillan Company,Newyork. 2. Barrow GM,(1992), Physical Chemistry,5thed., Tata McGraw Hill, NewDelhi. 3. Lee JD, (1991),Concise Inorganic Chemistry,4thed., ELBS WilliamHeinemann,London. 4. Huheey JE,(1993), Inorganic Chemistry: Principles of Structure andReactivity,4thed.,AddisonWesley PublishingCompany,India. 5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol–I,26thed., GoelPublishingHouse, Meerut. 6. AgarwalOP,(1995),ReactionsandReagentsinOrganicChemistry,8thed., Goel Publishing House, Meerut.

Website ande-learningso urce	https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.htmlhttp://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.i n/course/64-atomic-structure-and-chemical-bonding **MOOCcomponents** http://nptel.ac.in/courses/104101090/Lecture1:Classificationofelementsand periodicpropertieshttp://nptel.ac.in/courses/104101090/

CO1Explaintheconceptofacids,bases andionic equilibria;periodicpropertiesofsandp-blockelements, preparationand propertiesof aliphaticand aromatichydrocarbons.
CO2Discusstheperiodicproperties ofs andp-block elements,reactions ofaliphaticandaromatichydrocarbons andstrengthofacids.
CO3Classifyhydrocarbons,typesofreactions,acidsandbases,examinethepropertiesandp-block elements, reactionmechanisms of aliphaticand aromatichydrocarbons.
CO4Explain theories of acids, bases and indicators, buffer action and importantcompoundsof s-block elements.
CO5Assess the application of hard and soft acids indicators, buffers, compounds of sandp-block elements.

LevelofCorrelationbetweenPSO'sandCO's

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

CO-POMapping(CourseArticulationMatrix)

CO/PO	PSO 1	PSO 2	PSO 3	PSO 4	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 ofCourseContributionto Pos	3.0	3.0	3.0	3.0	3.0

<table>
<tr><td>Title of thecourse</td><td colspan="7">QUANTITATIVEINORGANICESTIMATION ANDINORGANICPREPARATION</td></tr>
<tr><td>Paper no.</td><td colspan="7">Core4</td></tr>
<tr><td>Category</td><td>CorePractical</td><td>Year
Semester</td><td>I
II</td><td>Credits</td><td>5</td><td>Course Code</td><td>U23CHP204</td></tr>
<tr><td>Instructional Hours perweek</td><td>Lecture
-</td><td>Tutorial
-</td><td colspan="2">LabPractice
5</td><td colspan="3">Total
5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Highersecondarychemistry</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">Thiscourseaimsatprovidingknowledgeon
• Laboratorysafety
• Handlingglasswares
• Quantitativeestimation
• Preparationofinorganiccompounds</td></tr>
<tr><td>Courseoutline</td><td colspan="7">UNITI
CommonApparatusUsedinQuantitativeEstimation(Volumetric)
Descriptionanduseofburette,pipette,standardflask,measuringcylinder,conicalflask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gaugeandtripod stand.
PrincipleofQuantitativeEstimation(Volumetric)
Equivalentweightofanacid,base,salt,reducingagent,oxidizingagent;conceptofmole,molality,molarity,normality;primaryandsecondarystandards,preparation of standard solutions; theoriesofacid-base,redox,complexometric,iodometricandiodometrictitrations;indicators–types,theoryofacid–base,redox,metalionandadsorptionindicators,choiceofindicators.</td></tr>
<tr><td></td><td colspan="7">UNITII
QuantitativeEstimation(Volumetric)
Preparationofstandardsolution,dilutionfromstocksolution
Acidimetryandalkalimetry
Titrationacids:hydrochloricacid,sulphuricacidStandardsolutionsprepared:sodium carbonate, sodium bicarbonate, oxalicacid.
Permanganometry
Estimationofferroussulphateandoxalicacidusingstandardferrousammoniumsulphate.
Dichrometry
Estimation of ferric alum using standard dichromate (external indicator)Estimationofferricalum usingstandarddichromate(internalindicator)</td></tr>
</table>

	Iodometry Estimationofcopperincoppersulphateusingstandarddichromate **Argentimetry(Demonstrationonly)** Estimationofchlorideinbariumchlorideusingstandardsodiumchloride/Estimationofchloridein sodiumchloride(Volhard'smethod)
	UNITIII **Complexometry** Estimationofhardness ofwaterusingEDTA **Preparation of Inorganiccompounds**Tetra ammine copper(II) sulphateMohr'sSalt
Skillsacquired Fromthiscourse	Knowledge,Problemsolving,Analyticalability,ProfessionalCompetency, ProfessionalCommunicationandTransferableskills.
RecommendedText	**ReferenceBooks:** 1. Venkateswaran,V.;Veeraswamy,R.;Kulandivelu, A.R. *Basic Principles ofPracticalChemistry*,2nded.;SultanChand&Sons:NewDelhi,1997. 2. Nad,A.K.;Mahapatra,B.;Ghoshal,A.;*Anadvanced course in PracticalChemistry,* 3rded.;NewCentral BookAgency:Kolkata,2007.
ReferenceBooks	1.Mendham,J.;Denney,R.C.;Barnes,J.D.;Thomas,M.;Sivasankar,B.; *Vogel'sTextbookofQuantitativeChemicalAnalysis*,6thed.;PearsonEducationLtd:NewDelhi,2000.
Website ande-learningsource	**WebReferences:** 1) http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis 2) https://chemdictionary.org/titration-indicator/

CourseLearningOutcomes (forMapping withPosandPSOs)

Onsuccessfulcompletionofthecoursethestudentsshouldbeableto

CO1 Explainthebasicprinciplesinvolve Titrimetricanalysisandinorganicpreparations.

CO2 Comparethemethodologiesofdifferenttitrimetricanalysis

CO3 Calculatetheconcentrationsofunknownsolutionindifferentwaysanddeveloptheskillestimatedtheamount of asubstance presentin agiven solution.

CO4 Assesstheyieldofdifferent inorganicpreparationsandidentify theendpointofvarioustitrations.

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

CO-POMapping(CourseArticulationMatrix)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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
Weightedpercentageof CourseContributionto Pos	3.0	3.0	3.0	3.0	3.0

Title of thecourse	**VOLUMETRICANALYSIS**						
Paper No.	**Elective – 2**						
Category	**Allied Practical**	**Year**	I	**Credits**	3	**Cours eCode**	U23CHE21
		Semester	II				
Instructional Hours perweek	**Lecture**	**Tutorial**	**LabPractice**			**Total**	
	-	-	4			4	
Prerequisites	HigherSecondary						

Thiscourseaimsatproviding knowledgeon

- laboratorysafety
- handlingglasswares
- Volumetricanalysis

Acidimetryandalkalimetry:Titrationacidsused:hydrochloricacid,sulphuricStandardsolutionsprepared:sodium carbonate, sodiumbicarbonate, oxalic acid.

Oxidationandreductiontitration: Oxidisingagents:Potassiumpermanganate(permanganometry)Reducingagents: Ferroussulphate,ferrous ammoniumSulphate,oxalic acid

Standardsolutionsprepared: FerrousSulphate,ferrousammoniumSulphateandoxalicacid.

Iodometrytitrations:titrationsofliberatediodineagainstsodiumthiosulphateusingacidifiedpotassiumpermanganate,potassiumdichromateandcopper Sulphatesolutions.

Standardsolutions:potassiumdichromate,coppersulphate.

TextBooks

1. Sundaram,Krishnan,Raghavan,PracticalChemistry(PartII),S.ViswanathanCo.Pvt.,1996.

2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry.5thEdn.,Pearson Education, 2005.

ReferenceBooks

1. PracticalChemistrybyA.O.Thomas,ScientificBookCentre,Cannanore,2003.

2. BasicPrinciplesofPracticalChemistry,V.Venkateswaran,R.Veeraswamy,A.R.Kulandaivelu,SultanCh

CO	Courseoutcomes	Remarks
CO1	LearntheconceptofTitrationmethodsandvariousTitrations	**K2**
CO2	UnderstandtheAcidimetryandalkalimetrytitrations	**K2**
CO3	Thepreparation ofstandard solutionsandmethodsofanalyzethevarioussalts	**K2,K4**
CO4	Understandthecalculationsofmolarity,molalityandNormalityofthesolutions	**K2**

<table>
<tr><td>Title of theCourse</td><td colspan="7">ENTREPRENEURIALSKILLSINCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC –3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SkillEnhancement Course</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td><td>U23CHS203</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional Hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td>1</td><td>-</td><td colspan="3">1</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">GeneralChemistry</td></tr>
<tr><td>Objectives of thecourse</td><td colspan="7">Thiscourseaimsatprovidingtrainingto
• Developentrepreneurskillsinstudents.
• Toprovidehandsonexperiencetoprepareanddevelopproducts.
• Developstartups</td></tr>
<tr><td>CourseOutline</td><td colspan="7">UNITI
MilkandMilkProducts
Composition of Milk- Flavour and aroma of Milk - Effect of heat on milk ;Pasteurisation ; Homogenisation - Some Milk products : Cheese, Paneer,Cream,Butter, IceCream,Milk powder,Curd andbuttermilk.</td></tr>
<tr><td></td><td colspan="7">UNITII
HandsonExperience (Studentscan chooseanyfour)
Detection of adulterants in food items like coffee, tea, pepper, chillipowder, turmeric powder, butter, ghee, milk, honey etc., by simpletechniques.
PreparationofJam,squashandJelly,Gulkand,cottagecheese.
Preparationofproductslikecandles,soap,detergents,cleaningpowder,shampoos,painbalm,toothpaste/ powderanddisinfectantsinsmallscale.
Testing of water samples using a testing kit.Dyeing–Cotton fabrics with natural and synthetic dyesPrinting–tieand dye, batik.</td></tr>
</table>

Skillsacquired Fromthiscourse	Entrepreneurialskills.
Recommended Text	1. GeorgeS&MuralidharanV,(2007)FibretoFinishedFabric–ASimpleApproach,PublicationDivision, Universityof Madras,Chennai. 2. AppaswamyGP,AHandbookonPrintingandDyeingofTextiles.
ReferenceBooks	Shyam Jha, Rapid detection of food adultery ants andcontaminants(Theory and Practice), Elsevier,e-BookISBN9087128004289,1st Edition,2015
Websiteand e-learningsource	https://www.vlab.co.in/broad-area-chemical-sciences
CourseLearningOutcomes (forMapping withPOsandPSOs) **Oncompletionofthecourse thestudentsshouldbeableto** **CO1:**Identifyadulteratedfooditemsbydoingsimplechemicaltests. **CO2:**Preparecleaningproductsandbecomeentrepreneurs **CO3:**Educateothersaboutadulterationandmotivatethemtobecomeentrepreneurs.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	S	S	S	S	S	S	S	M	S
CO2	M	S	S	S	M	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
Weightage	6	6	6	6	6
Weightedpercentageof CourseContributiontoPOs	3.0	3.0	3.0	3.0	3.0

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRYIII</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core – 5</td></tr>
<tr><td>Category</td><td>Core Theory</td><td>Year
Semester</td><td>II
III</td><td>Credits</td><td>5</td><td>Course Code</td><td>U23CHT305</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture
4</td><td>Tutorial
1</td><td colspan="2">Lab Practice
-</td><td colspan="3">Total
5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry–I and II</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide 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.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I

Gaseous state

Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell –Boltzmann distribution of speed of molecules-average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom of a gaseous molecule and contributions to heat capacity of an ideal gas. Collision frequency; collision diameter; mean free path.

Real gases: Deviations of Real gases from ideal gas behaviour, compressibility factor Z, and its variation with pressure for different gases (Z Vs P plots). Equations of states for real gases-vander Waal's equation; Virial equation ;Boyle temperature – Critical phenomena, critical constants of a gas –P−V isotherms of CO_2 (Andrews isotherms) – continuity of state–Vander Waal's equation and the critical state; law of corresponding states-liquefaction of gases – Joule Thomson effect, Adiabatic demagnetization (brief idea only) – Calculation of inversion temperature.</td></tr>
<tr><td></td><td colspan="7">Unit-II
Liquid and Solid State
Properties of Liquids-Surface tension, viscosity (definition and brief idea only) – surface active agents.
Crystalline and amorphous–differences-geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism.
Crystals–size and shape; laws of crystallography; symmetry elements–plane,Centre and axis; Miller indices, unit cells and space lattices;</td></tr>
</table>

	classification of crystal systems; Bravais lattices; X–ray diffraction– Bragg's equationPacking in atomic solids–simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures-NaCl, CsCl, ZnS, TiO_2; comparison of structure and properties of diamond and graphite. Defects in solids- point defects: Schottky defects, Frenkal defects – metal excess and metal deficiency defects – Line defects. **Liquid crystals: mesomorphic state**–classification of thermotrophic liquid crystals – Smectic, Nematic and cholesteric liquid crystals - applications.
	UNIT-III **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, isodiaphers; nuclear isomerism; radioactive decay series; magic numbers; units–Becquerel and 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
	Halogen derivatives: Aliphatic halogen derivatives Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions–S_N1, S_N2 and S_Ni mechanisms with stereo chemical aspects and effect of solvent.
	Halogen derivatives: Nomenclature, classification, preparation, properties and applications of $CHCl_3$.
	Aromatic halogen compounds Nomenclature, preparation, properties and uses of phenyl chloride. Mechanism of nucleophilic aromatic substitution–benzyne intermediate.
	Aryl alkyl halides Nomenclature, benzylchloride –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.Uses of thiols.
	UNIT-V **Phenols** Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raschig process; properties – acidic character and effect of substitution on acidity. Reactions – Electrophilic substitution reactions, Reimer-Tiemann, Kolbe, Schmidt, Gattermann synthesis, Liebermann, 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.
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,Problemsolving,Analyticalability,ProfessionalCompetency, Professional Communication and Transferable skills.
Recommended Text	1. B.R.Puri,L.R.Sharma,M.S.Pathania;*PrinciplesofPhysicalChemistry*, 46thedition,VishalPublishing,2020. 2. B.R.Puri,L.R.SharmaandK.C.Kalia,*PrinciplesofInorganicChemistry*, MilestonePublishersandDistributors,NewDelhi,thirtiethedition,2009. 3. 4.P.L.SoniandMohanKatyal,*TextbookofInorganicChemistry*,SultanCha nd& amp;Sons,twentiethedition,2006. 4. M.K.Jain,S.C.Sharma,*ModernOrganicChemistry*,VishalPublishing,four threprint,2003. **5.** S.M.Mukherji,andS.P.Singh,*ReactionMechanisminOrganicChemistry*, MacmillanIndiaLtd.,thirdedition,1994.

Reference Books	1. T.W.GrahamSolomons,*OrganicChemistry*,JohnWiley&Sons, fifthedition,1992. 2. A.CareyFrancis,*OrganicChemistry*,TataMcGraw-HillEducationPvt.,Ltd.,NewDelhi,seventhedition,2009. 3. I.L.Finar ,*Organic Chemistry*, Wesley Longman Ltd, England, sixth edition,1996. 4.P. L. Soni, and H. M.Chawla - Text Book of Organic Chemistry, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007. 5. J.D. Lee, Concise Inorganic Chemistry, Blackwell Science, fifth edition, 2005.
Website and e-learning source	**MOOC components** https://nptel.ac.in/courses/104104101Solid state chemistry https://nptel.ac.in/courses/103106071 Nuclear industries and safety https://nptel.ac.in/courses/104106119sIntroduction to organic chemistry

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1:explainthekineticpropertiesofgasesbyusingmathematicalconcepts.
CO2:describethephysicalpropertiesofliquidandsolids;identifyvarioustypesofcrystals withrespecttotheirpacking andapplytheXRDmethodforcrystalstructuredeterminations.
CO3:investigateradioactivity,nuclearenergyanditsproduction,alsonuclearwastemanagement.
CO4:writethenomenclature,physical&chemicalpropertiesandbasicmechanismsofhaloorganicco mpoundsandalcohols.
CO5:investigatethenamedorganicreactionsrelatedtophenol;explainthepreparationandpropertiesof aromaticalcohol.

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

CO-PO Mapping (Course Articulation Matrix)

CO/PO	PSO 1	PSO 2	PSO 3	PSO 4	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

Level of Correlation between PSO's and CO's

<table>
<tr><td>Title of the Course</td><td colspan="7">QUALITATIVE INORGANIC ANALYSIS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core 6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Practical</td><td>Year</td><td>II</td><td>Credits</td><td>5</td><td>Course Code</td><td>U23CHP306</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">5</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.</td></tr>
<tr><td>Course Outline</td><td colspan="7">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,
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, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium
5. Analysis of a mixture - I to VI containing two cations and two anions (of which one is interfering type)</td></tr>
<tr><td>Skills acquired from This course</td><td colspan="7">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">Reference Books:
V.Venkateswaran,R.VeeraswamyandA.R.Kulandivelu,BasicPrinciplesofPracticalChemistry,SultanChand&Sons,NewDelhi,secondedition,1997.</td></tr>
<tr><td>Website and e-learning source</td><td colspan="7">https://www.vlab.co.in/broad-area-chemical-sciences</td></tr>
<tr><td colspan="8">Course Learning Outcomes (for Mapping with Pos and PSOs)</td></tr>
</table>

On successful completion of the course the students should be able to

CO1:acquireknowledgeonthesystematicanalysisofMixtureofsalts.

CO2:identifythecationsandanionsintheunknownsubstance.

CO3:identifythecationsandanionsinthesoilandwaterandtotestthequalityofwater.

CO4:assesstheroleofcommonioneffectandsolubilityproduct

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

CO/PO	PSO 1	PSO 2	PSO 3	PSO 4	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

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-IV</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core 7</td></tr>
<tr><td>Category</td><td>Core Theory</td><td>Year
Semester</td><td>II
IV</td><td>Credits</td><td>5</td><td>Course Code</td><td>U23CHT407</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture
4</td><td>Tutorial
1</td><td colspan="2">Lab Practice
-</td><td colspan="2">Total
5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry III</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide a comprehensive knowledge on
• Thermodynamic concepts on chemical processes and applied aspects.
• Thermo chemical calculations
• Transition elements with reference to periodic properties and group study of transition metals.
• The organic chemistry of ethers, aldehydes and ketones
• The organic chemistry of carboxylic acids</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I

Thermodynamics I
Terminology–Intensive,extensivevariables,state,pathfunctions;isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics –Concept and significance of heat (q), work (w), internal energy (E),
enthalpy(H); calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (Cp &Cv); Joule Thomson effect- inversion temperature.

Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff’s equations) and pressure on enthalpy of reactions; Hess’s law and its applications;
Zeroth law of thermodynamics-Absolute Temperature scale.</td></tr>
</table>

	UNIT II **Thermodynamics II** Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder.
	Free energy and work functions -Need for free energy functions, Gibbs free energy, Helmholtz free energy-their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation –derivations and applications; Maxwell relationships.
	UNIT III **General Characteristics of d-block elements** **Transition Elements-**Electronic Configuration-General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non-transition elements–comparison of II and III transition series with I transition series. Group study of Titanium and Vanadium. (based on its position in the periodic table, physical properties, oxidation states and comparison of their compounds)
	UNIT IV **Ethers**
	Nomenclature, isomerism, general methods of preparations–dehydration of alcohols and Williamson synthesis, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen.Zeisel's method of estimation of methoxy group. A brief idea on thioethers and epoxides. **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 catalyzed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction,

	UNITV **Carboxylic Acids**: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituents on acidic strength. HVZ reaction, Claisen ester condensation, Reactions of dicarboxylic acids and unsaturated acids (Maleic acid, fumaric acid and Cinnamic acid).
	Carboxylic acid Derivatives: Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides.Nucleophilic substitution reaction at the acyl carbon of acylhalide, anhydride, ester, amide. Schottan-Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation. **Active methylene compounds:** Keto–enol tautomerism. Preparation and synthetic Applications of diethyl malonate and ethyl acetoacetate **Halogen substituted acids**–nomenclature and comparison of acidity. **Hydroxy acids**–Nomenclature, preparation from aldehydic and ketonic acids. Reactions of lactic acid.
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	1. B.R.PuriandL.R.Sharma,*PrinciplesofPhysicalChemistry*,ShobanLalNaginChandandCo.,thirtythreeedition,1992. 2. K.L.Kapoor,*ATextbookofPhysicalchemistry*,(volume-2and3),Macmillan,IndiaLtd,thirdedition,2009. 3. P.L.SoniandMohanKatyal,*TextbookofInorganicChemistry*,SultanChand&Sons,twentiethedition,2006. 4. M.K.Jain,S.C.Sharma,*ModernOrganicChemistry*,VishalPublishing,fourthreprint,2003. 5. S.M.Mukherji,andS.P.Singh,*ReactionMechanisminOrganicChemistry*,MacmillanIndiaLtd.,thirdedition,1994.
Reference Books	1. Maron,S.H.andPruttonC.P.*PrinciplesofPhysicalChemistry*,4th ed.;TheMacmillanCompany:Newyork,1972. 2. Lee,J.D.*ConciseInorganicChemistry*,4thed.;ELBSWilliamHeinemann:London,1991. 3. GurudeepRaj,*AdvancedInorganicChemistry*,26th ed.;GoelPublishingHouse: Meerut,2001. 4. Atkins,P.W.&Paula,J.*PhysicalChemistry*,10thed.;OxfordUniversityPress:NewYork,2014. 5. Huheey,J.E.*InorganicChemistry:PrinciplesofStructureandReactivity*,4th ed;AddisonWesleyPublishingCompany:India,1993.
Website and e-learning source	**MOOCcomponents**https://nptel.ac.in/courses/112102255Thermodynamics https://nptel.ac.in/courses/104101136Advancedtransitionmetalchemistry

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

CO-PO Mapping (Course Articulation Matrix)

CO/PO	PSO 1	PSO 2	PSO 3	PSO 4	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

Level of Correlation between PSO's and CO's

<table>
<tr><td>Title of the Course</td><td colspan="7">GRAVIMETRIC ESTIMATION & ORGANIC PREPARATION</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core 8</td></tr>
<tr><td>Category</td><td>Core Practical</td><td>Year
Semester</td><td>II
IV</td><td>Credits</td><td>5</td><td>Course Code</td><td>U23CHP408</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture
-</td><td>Tutorial
-</td><td colspan="2">Lab Practice
5</td><td colspan="3">Total
5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Foundation course</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• handling glassware
• Quantitative estimation gravimetrically
• preparation of organic compounds</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I Principles of gravimetric analysis

Gravimetric Analysis Mechanism of precipitate formation - Factors affecting solubility of precipitates – co-precipitation and post precipitation - Effect of digestion - washing, drying and ignition of precipitates.</td></tr>
<tr><td></td><td colspan="7">UNIT II Gravimetric Estimation

1. Estimation of Ca as calcium oxalate monohydrate
2. Estimation of Ba as Barium chromate
3. Estimation of Lead as Lead Chromate</td></tr>
<tr><td></td><td colspan="7">UNIT III
Organic Preparation

1. Hydrolysis – Ester hydrolysis
2. Amide hydrolysis
3. Benzoylation of beta naphthol amines
4. Acetylation of an amine
5. Nitration of acetanilide
6. Oxidation: Benzoic acid from benzaldehyde</td></tr>
</table>

Recommended Text	Text Books 1. O.P. Agarwal, Advanced Practical Organic Chemistry, Krishna Prakashan Media (P) Ltd, 2014. 2. Mann &Saunders, Practical Organic Chemistry, fourth edition Pearson Education India, 2009.
Reference Books	1. V. K. Ahluwalia, P. Bhagat, and R. Agarwal, Laboratory Techniques in Organic Chemistry; I. K. International, 2005. 2. V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, 2nd Edn., 2004.

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: explain the principles of gravimetric analysis.
CO2: demonstrate the quantitative estimation of inorganic compound gravimetrically.
CO3: do the preparation of organic compounds.
CO4: exhibit recrystallisation of the crude sample

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

CO-PO Mapping (Course Articulation Matrix)

CO/PO	PSO 1	PSO 2	PSO 3	PSO 4	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

Level of Correlation between PSO's and CO's

<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANICCHEMISTRY-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core 9</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Theory</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">U23CHT509</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide an understanding of
Stereoisomerisminchiralsandgeometricisomerisminolefins, conformationsof ethane and butane
preparation and properties of aromatic and aliphatic nitro compounds and amines
preparation of different dyes, food colour and additives
preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNITI
Stereochemistry
Fischer Projection, Newmann and Sawhorse Projection formulae and their inter conversions.
Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations.
Optical Isomerism:
Opticalactivity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centers, racemisation-methods of racemisation; resolution-methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.
Molecules with no asymmetric carbon atoms–allenes and biphenyls.
Conformational analysis of ethane and butane.</td></tr>
</table>

	UNITII **Chemistry of Nitrogen Compounds–I** **Nitroalkanes** Nomenclature, isomerism, preparation from alkylhalides, haloacids, alkanes; physical properties; reactions–reduction, halogenations, Grignard reagent, Pseudo acid character. **Aromatic nitro compounds** Nomenclature, preparation–nitration, from diazonium salts, physical properties ;reactions- reduction of nitro benzene in different medium, Electrophilic substitution reactions, TNT.
	Amines: Aliphatic aminesNomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis. Physical properties, reactions – alkylation, acylation, carbylamine reaction, Mannich reaction,oxidation, basicity of amines.
	UNIT III **Chemistry of Nitrogen Compounds – II** **Aromatic amines** – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation. Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compoundsDiazomethane, Benzenediazonium chloride - preparations and synthetic applications. **Dyes** Theory of colour and constitution; classification based on structure and application; preparation –Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green. Industry oriented content: Dyes Industry, Food colour and additives

	UNIT IV **Heterocyclic compounds** Nomenclature and classification. General characteristics-aromatic character and reactivity. Five-membered heterocyclic compounds Pyrrole–preparation-from succinimide, Paal Knorr synthesis; reactions–reduction, basic character, acidic character, electrophilic substitution reactions, ring opening. Furan–preparation from mucic acid and pentosan; reactions–hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction. Thiophene synthesis-from acetylene; reactions–reduction; oxidation; electrophilic substitution reactions.
	UNIT V **Six-membered heterocyclic compounds** Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses. Condensed ring systems Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.
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	1.M.K.Jain,S.C.Sharma,ModernOrganicChemistry,VishalPub lishing,fourthreprint,2009. 2.S.M.Mukherji,andS.P.Singh,ReactionMechanism inorganic Chemistry,MacmillanIndiaLtd.,thirdedition,2009. 3. ArunBahlandB.S.Bahl,Advancedorganicchemistry,NewDelhi, S.Chand&CompanyPvt.Ltd.,Multicolouredition,2012. 4.P.L.SoniandH.M.Chawla,TextBookofOrganicChemistry,SultanCh and&Sons,NewDelhi,twentyninthedition,2007. 5.C.N.Pillai,TextBookofOrganicChemistry,UniversitiesPress(India) PrivateLtd.,2009.
Reference Books	1.R.T.MorrisonandR.N.Boyd,OrganicChemistry,PearsonE ducation,Asia,sixthedition,2012. 2. T.W.GrahamSolomons,OrganicChemistry,JohnWiley&Sons, Eleventhedition,2012. 3.A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition,2009. 4.I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006. 5.J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.
Website and e-learning sources	1.www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in VirtualTextbookofOrganicChemistry

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: assign RS notations to chirals and EZ notations tool elfins and explain conformations of ethane and butane.

CO2:explainpreparationandpropertiesofaromaticandaliphaticnitrocompoundsandamines

CO3:explaincolourandconstitutionofdyesandfoodadditives

CO4:discusspreparationandpropertiesoffive-memberedheterocycleslikepyrrole,furanandthiophene

CO5:discusspreparationandpropertiesofsixmemberedheterocycleslikepyridine,quinolineandisoquinoline

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

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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

Level of Correlation between PSO's and CO's

<table>
<tr><td>Title of the Course</td><td colspan="8">INORGANIC CHEMISTRY-I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core 10</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Theory</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td colspan="2">U23CHT510</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="5"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims to provide knowledge on
• Nomenclature, isomerism and theory ofcoordination compounds, and chelate complexes.
• Crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
• preparation and properties of metal carbonyls
• Lanthanoids and actinoids
• Preparation and properties of inorganic polymers</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I
Co-ordination Chemistry-I
IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds.
Werner’s coordination theory –effective atomic number – interpretation of geometry and magnetic properties by Pauling’s theory – geometry of co-ordination compounds with co-ordination number 4&6.

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

Role of metal chelates in living systems–hemoglobin and chlorophyll.</td></tr>
<tr><td></td><td colspan="8">UNIT II
Co-ordination Chemistry-II

Crystal field theory–Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy(CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes-factors influencing the magnitude of crystal field splitting, interpretation of magnetic properties, spectra of $[Ti(H_2O)_6]^{3+}$- Jahn–Teller effect.Stability of complexes in aqueous solution, stability constants. Comparison of VBT and CFT.</td></tr>
</table>

	UNITIII **Organo metallic compounds** **Metal Carbonyls** Mono and poly nuclear carbonyls, General methods of preparation of carbonyls–general properties of binary carbonyls–bonding in carbonyls–structure and bonding in carbonyls of Ni and Fe. EAN rule as applied to metal carbonyls. Ferrocene- Methods of preparation, physical and chemical properties
	UNITIV **Inner transition elements (Lanthanoids and Actinoids)** General characteristics of f-block elements-Comparative account of lanthanoids and actinoids-Occurrence, Oxidation states, Magnetic properties, Colour and spectra- Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods-Lanthanoids Contraction-Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses-Preparation, Properties and uses of ceric ammoniumsulphate, thorium dioxide and uranylacetate.
	UNITV **Industrial Applications of Inorganic Compounds** Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti-skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels. Nano composite Hydrogels: synthesis, characterization and uses. Industrial applications of inorganic polymers.
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,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. PuriBR,SharmaLR,KaliaKC(2011),PrinciplesofInorganicChemistry,31th Edition,MilestonePublishers&Distributors,Delhi. 2. SatyaPrakash,TuliG.D.,BasuS.K.,MadanR.D.(2009),

	AdvancedInorganicChemistry,18th Edition,S.Chand&Co.,New Delhi 3. LeeJD,(1991),ConciseInorganicChemistry,4th Edition,ELBSWilliamHeinemann,London. 4. WVMalik,GDTuli,RDMadan,(2000),SelectedTopicsinInorganic Chemistry,S.ChandandCompanyLtd. 5. A.K.De,TextbookofInorganicChemistry,WileyEastLtd,seventhedition,1992.
Reference Books	1. MadanRD,SathyaPrakash,(2003),ModernInorganicChemistry,2nd ed .,S.ChandandCompany,NewDelhi. 2. GopalanR,(2009)InorganicChemistryforUndergraduates, 1st Edition,UniversityPress(India)PrivateLimited,Hyderabad 3. SivasankarB,(2013)InorganicChemistry. 1st Edition,Pearson,Chennai 4. AlanG.Sharp(1992),InorganicChemistry,3rd Edition,Addition-Wesley,England 5. PeterAtkins,TinaOverton,JonathanRourkeandMarkWeller,InorganicChemistry,OxfordUniversityPress,sixthedition,2014.
Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in

Course Learning Outcomes(for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: explainisomerism,Werner'sTheoryandstabilityofchelatecomplexes

CO2: discusscrystalfieldtheory,magneticpropertiesandspectralpropertiesofcomplexes.

CO3: explainpreparationandpropertiesofmetalcarbonyls

CO4: giveacomparativeaccountofthecharacteristicsoflanthanoidsandactinoids

CO5: explainpropertiesandusesofinorganicpolymersofsilicon,sulphur,boronandphosphorous.

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

CO/PSO	PSO 1	PSO 2	PSO 3	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

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICAL CHEMISTRY-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core -11</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Theory</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>U23CHT511</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I, II, III and I V</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of
Gibbs free energy, Helmholtz free energy, Ellingham’s diagram and partial molar properties
Chemical kinetics and different types of chemical reactions
adsorption, homogeneous and heterogeneous catalysis
colloids and macromolecules
photochemistry, fluorescence and phosphorescence</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNITI
Thermodynamics-III

Third law of thermodynamics-Nernst heat theorem; Applications of third law -evaluation of absolute entropies from heat capacity measurements, exceptions to third law.
Partial molar properties –chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs-Duhem-Margules equation.</td></tr>
<tr><td></td><td colspan="7">UNIT II

Chemical Kinetics

Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration)–Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry.</td></tr>
</table>

	Effect of temperature on reaction rate–temperature coefficient-concept of activation energy - Arrhenius equation. Theories of reactionrates– Collisiontheoryderivationofrateconstantofbimoleculargaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction –significance of entropy and free energy of activation. Comparison of collision theory and ARRT. Complex reactions – reversible and parallel reactions (no derivation and only examples)Kinetics of consecutive reactions–steady state approximation.
	UNIT III **Adsorption**–Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms –Freundlich and Langmuir. Adsorption isotherms and their limitations –BET theory, kinetics of enzyme catalysed reaction –Michaelis- Mentenand Briggs- Haldene equation – Lineweaver-Burk plot – inhibition –reversible–competitive, noncompetitive and uncompetitive (no derivation of rate equations) Catalysis – general characteristics of catalytic reactions, auto catalysis,promoters,negativecatalysis,poisoningofacatalyst–theoriesofhomogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis. Heterogeneous catalysis
	UNIT IV **Chemical equilibrium** Law of mass action – thermodynamic derivation – relationship between Kp and Kc –application to the homogeneous equilibria – dissociation of PCl5 gas,N2O4 gas –equilibrium constant and degree of dissociation - formation of HI, NH3 ,and SO3 –heterogeneous equilibrium – decomposition of solid calcium carbonate –Lechatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – Clausius Clayperon equation and its applications

	UNIT V **Photochemistry** Laws of photo chemistry–Lambert–Beer, Grotthus–Draper and Stark–Einstein. Quantum efficiency. Photo chemical reactions–rate law–Kinetics of H_2-Cl_2, H_2-Br_2 and H_2-I_2 reactions, comparison between thermal and photochemical reactions. Fluorescence–applicationsincludingfluorimetry–sensitisedfluorescence, phosphorescence – applications – chemiluminescence and photosensitization– examples Chemistry of Vision–11 cis retinal–vitamin A as a precursor-colour perception of vision
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, Problemsolving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. B.R.PuriandL.R.Sharma,PrinciplesofPhysicalChemistry, ShobanLalNaginChandandCo.,fortyeighthedition,2021. 2. PeterAtkins,andJuliodePaula,JamesKeeler,PhysicalChemistry,OxfordUniversitypress,Internationaleleventhedition,2018. 3. ArunBahl,B.S.Bahl,G.D.TuliEssentialsofphysicalchemistry,28thedition2019,S,Chand&Co. 4. S.K.DograandS.Dogra,PhysicalChemistrythroughProblems:NewAgeInternational,fourthedition,1996. 5. J.RajaramandJ.C.Kuriacose,Thermodynamics, ShobanLalNaginChandandCO.,1986.

Website and e-learning source	1. https://nptel.ac.in 2. https://swayam.gov.in 3. www.epgpathshala.nic.in

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellinghams

CO2: apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.

CO3: compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.

CO4: demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.

CO5: utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

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

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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

Level of Correlation between PSO's and CO's

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICAL CHEMISTRY
PRACTICAL</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core -12</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Practical</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>U23CHP512</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">5</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Theoretical knowledge on physical chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing
• Basic principles of physical chemistry experiments
• Hands on experience in carrying out the experiments</td></tr>
<tr><td>Course Outline</td><td colspan="7">Phase diagrams
Simple eutectic-determination of eutectic temperature and composition of naphthalene-diphenylamine or naphthalene-diphenyl system
1. Determination of transition temperature of a salt hydrate.
2. Determination of upper critical solution temperature of phenol–water system
3. Effect of an electrolyte on miscibility temperature of phenol–water system and
4. Determination of concentration of sodium chloride using phenol-sodium chloride system.
Distribution law
5.Determination of the distribution coefficient of iodine between carbon tetrachloride and water.
6. Determination of equilibrium constant of the reaction
$I_2 + I^- \rightleftharpoons I_3^-$
7. Determination of concentration of the given potassium iodide solution using equilibrium constant.
Chemical kinetics
8. Determination of rate constant of acid catalysed hydrolysis of an ester (Methyl acetate).
9. Determination of order of reaction between iodide and persulphate (initial rate method).
Colligative Property & Electrochemistry
10. Determination of Kf and molecular weight of a solute by Rast method
11.Conductometric titration of hydrochloric acid against sodium hydroxide</td></tr>
</table>

Extended Professional Component(is a Part of internal Component only, Nott o 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.
Reference Books	1. Sindhu,P.S.*PracticalsinPhysicalChemistry*,MacmillanIndia:NewDelhi,2005. 2. Khosla,B.D.Garg,V.C.;Gulati,A.*SeniorPracticalPhysicalChemistry*,R.Chand:NewDelhi,2011. 3. Gupta,Renu,*PracticalPhysicalChemistry*,1st Ed.;NewAgeInternational:NewDelhi,2017.
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: Describe theprinciplesandmethodologyforthepracticalwork.
CO2: Explaintheprocedure,dataandmethodologyforthepracticalwork
CO3: Applytheprinciplesofphaseruleandelectrochemistryforcarryingoutthepracticalwork
CO4: Demonstratelaboratoryskillsforsafehandlingoftheequipmentandchemicals

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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 PSOs	3.0	3.0	3.0	3.0	3.0

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
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 PO's and CO's

<table>
<tr><td>Title of the Course</td><td colspan="7">SPECTROSCOPY AND ANALYTICAL TECHNIQUES</td></tr>
<tr><td>Paper No.</td><td colspan="7">Subject Based Elective 5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective 5 Theory</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">U23CHE55A</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>3</td><td>-</td><td colspan="2">-</td><td colspan="3">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course is designed to provide knowledge on
The principles of chromatographic separation.
Basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry.
Instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry.
Applications of various spectral techniques instructural elucidation.
Solving combined spectral problems.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNITI

Separation and purification techniques
Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms and Rf value.</td></tr>
<tr><td colspan="7">UNITII
Ultraviolet and Visible spectroscopy
Regions of electromagnetic spectrum – parameters of electromagnetic radiation.
Electronic spectra of diatomic molecules (Born Oppenheimer approximation) -Beer –Lambert's law, Types of electronic transitions, σ -σ *, π-π*, n-σ*, n-π* transitions. chromophore, auxochrome, absorption maximum (λ max) and intensity of absorption bands, factors influencing λ max and intensity - instrumentation of UV-Visible spectrophotometer, Frank-Condon principle.</td></tr>
</table>

	UNIT III **Infrared spectroscopy** Vibration spectra –diatomic molecules – harmonic oscillator and Anharmonic oscillator; Vibration–rotation spectra–diatomic molecule as rigid rotator and anharmonic oscillator (Born-Oppenheimer Approximation oscillator)-selection rules, vibrations of polyatomic molecules– stretching and bending vibrations – applications – Determination of force constant, moment of inertia and inter nuclear distance–isotopic shift–application of IR spectra to simple organic And inorganic molecules–(group frequencies)
	UNITIV **Raman Spectroscopy** Rayleigh scattering and Raman scattering of light–Raman shift–Classical theory of Raman effect–quantum theory of Raman effect–Vibrational Raman spectrum–selection rules–mutual exclusion Principle–instrumentation (block diagram)–applications.
	UNITV **Nuclear magnetic resonance spectroscopy:** PMR–theory of PMR–instrumentation-number of signals–chemical shift– peak areas and proton counting – spin-spin coupling – applications. Problems related to shielding and deshielding of protons, chemical shifts of protons in hydrocarbons,and in simple mono functional organic compounds; spin-spin splitting of neighboring protons in vinyl and allyl systems.
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	1. Gopalan,R.;Subramaniam,P.S.;Rengarajan,K.*Elementsof AnalyticalChemistry*;SChand:NewDelhi,2003. 2. Usharani,S.*AnalyticalChemistry*,1st ed.;Macmillan:India,2002. 3. Banwell,C.N.;McCash,E.M.*FundamentalsofMolecularS pectroscopy*,4th ed.;TataMcGrawHill,NewDelhi,2017. 4. U.N.Dash,AnalyticalChemistryTheoryandPractice,SultanChand &Sons,2nd Ed.,2005 5. B.K.Sharma,Spectroscopy,22nd ed.,GoelPublishingHouse,2011.
Reference Books	1. Srivastava, A. K.; Jain, P. C. *Chemical Analysis an InstrumentalApproach*,3rd ed.;S.Chand,NewDelhi,1997. 2. Robert D Braun. *Introduction to Instrumental Analysis*; Mc.GrawHill:New York,1987. 3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. *Fundamentalsof Analytical Chemistry*,9th ed.; Harcourt college Publishers: USA,2013. 4. Madan, R. L.; Tuli, G. D. *Physical Chemistry*, 2nd ed.; S.Chand: NewDelhi,2005. 5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. *Principles of PhysicalChemistry*,43rd ed.;VishalPublishing:Delhi,2008.
Website and e-learning source	1.http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf 2.http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.html 3. www.epgpathshala.nic.in 4. www.nptel.ac.in 5..http:/swayam.gov.in

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1:explainelectricalandmagneticpropertiesofmaterialsandmicrowavespectroscopy

CO2:explaintheory,instrumentationandapplicationsofInfraredandRamanspectroscopy

CO3:applyselectionrulestounderstandspectraltransitions,explainWoodward–Fieser's rule for the calculation of wavelength maximum of conjugated dienes

CO4: explain theory, instrumentation and applications of NMR spectroscopy

CO5:explaintheory,instrumentationandapplicationsofMassspectrometry

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M

CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**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 eof 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 Course	**INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**						
Paper No.	**Subject Based Elective 5**						
Category	**Elective 5**	**Year**	III	**Credits**	3	**Cours**	U23CHE55B

	Theory	**Semester**	V			**e Code**	
Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	3	-	-			3	
Prerequisites	General Chemistry						
Objectives of the course	The course aims at providing an overall view of the • Operation and troubleshooting of chemical instruments. • fundamentals of analytical techniques and its application in the characterization of compounds • theory of chromatographic separation and • theory of thermo / electro analytical techniques • stoichiometry and the related concentration terms						

Course Outline	**UNIT-I** **Qualitative and Quantitative Aspects of Analysis** S.IUnits, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations Sampling, evaluation of analytical data, Errors –Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q-test, F-test, T-test. The Least Square Method for Deriving Calibration plots.
	UNIT II **Atomic Absorption Spectroscopy**: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

	UNIT III **UV-Visible and IR Spectroscopy** Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. **UV-Visible Spectrometry:** Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomer's. **Infrared Spectroscopy:** Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.
	UNIT IV **Thermal and Electro-analytical Methods of Analysis** TGA and DTA-Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate DSC-Principle, Instrumentation and applications. Electro analytical methods: polarography- principle, Instrumentation and applications. Derivative polarography- Cyclic Voltammetry-principle.
	UNIT V **Separation and purification techniques** Classification, principle, Factors affecting - Solvent Extraction – Liquid- Liquid Extraction, Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition & ion exchange. 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	1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis(Rev. by G.H. Jeffery and others) 5th Ed., The English LanguageBookSocietyofLongman. 2. R. Gopalan, P. S.Subramanian and K. Rengarajan, Elements ofAnalyticalChemistry,SultanChand,NewDelhi,2007 3. Skoog,HollerandCrouch,PrinciplesofInstrumentalAnalysis,CengageLearning,6thIndianReprint(2017). 4. R.Speyer,ThermalAnalysisofMaterials,CRCPress,1993. 5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6thedn.,PrenticeHallofIndiaPrivateLtd.,NewDelhi,1993
Reference Books	1. D. A. Skoog,D.M. West and F. J. Holler, Analytical Chemistry:AnIntroduction,5thedn.,Saunderscollegepublishing,Philadelphia,1998. 2. DashUN,AnalyticalChemistry;TheoryandPractice,SultanChandandsonsEducationalPublishers,NewDelhi,2011. 3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley &Sons,NewYork,2004. 4. Mikes,O.&Chalmes,R.A.LaboratoryHandbookofChromatographic &AlliedMethods,EllesHarwoodLtd.London 5. G.H.Jeffery,J.Bassett,J.MendhamandR.C.Denney,Vogel'sTextbookofQuantitativeChemicalAnalysis,sixtheditionPearsonEducation,2000.
Website and e-learning sources	1. http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf 2. http://eric.ed.gov/?id=EJ386287 3. http://www.sjsu.edu/faculty/watkins/diamag.htm 4. http://www.britannica.com/EBchecked/topic/108875/separation-and-purification 5. http://www.chemistry.co.nz/stoichiometry.htm

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1:applyerroranalysisinthecalibrationanduseofanalyticalinstruments,explaintheory,instrumentationandapplicationofflamephotometryandAtomicAbsorptionspectrometry
CO2:explaintheory,instrumentationandapplicationofUVvisibleandInfraredspectroscopy.
CO3:abletodiscussion instrumentation,theoryandapplicationsofthermalandelectrochemicaltechniques.
CO4:explaintheuseofchromatographictechniquesintheseparationandidentificationofmixtures.
CO5:explainpreparationofsolutions,stoichiometriccalculations

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

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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

<table>
<tr><td>Title of the Course</td><td colspan="7">BIOCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">SUBJECT BASED ELECTIVE 6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective 6 Theory</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">U23CHE56A</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>3</td><td></td><td colspan="2">-</td><td colspan="3">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Organic Chemistry-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing knowledge on
• Relationship between biochemistry and medicine, composition of blood
• Structure and properties of amino acids, peptides, enzyme, vitamins and proteins
• Biological functions of proteins, enzymes, vitamins and hormones
• Biochemistry of nucleic acids and lipids
• Metabolism of lipids</td></tr>
</table>

<table>
<tr><td>Course Outline</td><td>UNIT I
Logic of Living Organisms
Relationship of Biochemistry and Medicine
Blood-Composition of Blood, Blood Coagulation–Mechanism. Hemophilia and Sickle Cell Anemia
Maintenance of pH of Blood–Bicarbonate Buffer, Acidosis, Alkalosis.</td></tr>
<tr><td></td><td>UNIT II
Peptides and Proteins
Amino acids – nomenclature, classification – essential and Non-essential;Synthesis – GabrielPhthalimide,Strecker;properties–zwitter Ion and isoelectric point, electrophoresis and reactions.

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

Proteins–classification based on composition, functions and structure; Properties and reactions– colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure Of proteins– primary, secondary, tertiary and quaternary.
Metabolism of Aminoacids –general aspects of metabolism(a brief Outline); urea cycle.</td></tr>
<tr><td></td><td>UNIT III
Enzymes and Vitamins
Nomenclature and classification, characteristics, factors influencing</td></tr>
</table>

	Enzyme activity–mechanism of enzyme action–Lock and key hypothesis, Koshland's induced fit model. Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes–functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, Cyano cobalamin.
	UNIT IV **Aminoacids** Components of nucleic acids-nitrogenous bases and pentose sugars, Structure of nucleosides and nucleotides, DNA- structure & functions; RNA – types– structure - functions; biosynthesis of proteins **Hormones** Adrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).
	UNIT V **Lipids** Occurrence, biological significance of fats, classification of lipids. **Simple lipids**–Oils and fats, chemical composition, properties, reactions –hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats–saponification number, iodine number, acid value, R.M.value. Distinction between animal and vegetable fats. **Compound lipids** – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance. Cholesterol–occurrence, structure, test, physiological activity. Metabolism of lipids: β-oxidation of fatty 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)
Skills acquired From this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	1. Bahl,B.S.;Bhal,A.*AdvancedOrganicChemistry*,3rded.;S.Chand: NewDelhi,2003. 2. Jain, M.K.; Sharma, S.C. *ModernOrganicChemistry*,VishalPublications:NewDelhi,2017. 3. Shanmugam,A.*FundamentalsofBiochemistryforMedicalStudents*,6thed.; Publishedbythe author,1999. 4. Veerakumari,L.*Biochemistry*,1sted.;MJPPublications:Chennai,2004. 5. Jain,J.L.;*FundamentalsofBiochemistry*,2nded.;S.Chand:New Delhi,1983.
Reference Books	1. Conn,E.E.;Stumpf,P.K.*OutlineofBiochemistry*,5thed.;WileyEastern:NewDelhi,2002. 2. West,E.S.;Todd,W.R.;Mason,H.S.;VanBruggen,J.T.*TextBookofBiochemistry*,4thed.;Macmillan:NewYork,1970. 3. Lehninger,A.L.*PrinciplesofBiochemistry*,2nded.;CBSPublisher:Delhi,1993. 4. Rastogi,S.C.*Biochemistry*,2nded.;TataMcGraw-Hill:NewDelhi, 2003. 5. 5. Chatterjea, M. N.; Shinde, R. Textbook of Medical Biochemistry, 5th ed.; Jaypee Brothers: New Delhi, 2002.
Website and e-learning source	1)http://library.med.utah.edu/NetBiochem/nucacids.html 2)http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html 3) https://swayam.gov.in/courses/4384-biochemistryBiochemistry https://onlinecourses.nptel.ac.in/noc19_cy07/previewExperimental Biochemistry.

CourseLearningOutcomes(forMappingwithPosandPSOs)Oncompletionofthecoursethestudentsshouldbeableto

CO1:explainmolecularlogicoflivingorganisms,compositionofbloodandbloodcoagulation

CO2:explainsynthesisandpropertiesofaminoacids,determinationofstructureofpeptidesandproteins

CO3:explainfactorsinfluencingenzymeactivityandvitaminsascoenzymes

CO4:explainRNAandDNAstructureandfunctions

CO5:explainbiologicalsignificanceofsimpleandcompoundlipids

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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

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

<table>
<tr><td>Title of the Course</td><td colspan="7">PHARMACEUTICAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Subject Based Elective 6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective 6 Theory</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>U23CHE56B</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td></td><td colspan="3">-</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Knowledge on active chemical compounds and biochemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of
• drugs design and drug metabolism
• important Indian medicinal plants, common diseases and antibiotics
• drugs for major diseases like cancer, diabetes and AIDS
• analgesics and antipyretic agents
• significance of clinical tests</td></tr>
</table>

<table>
<tr><td rowspan="2">Course Outline</td><td>UNIT I
Introduction
Important terminologies–drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index.

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

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

Development of Drugs
Development of a drug–classic steps-lead compounds-comparison of traditional and modern methods of development of drugs–drug design By method of variation–disjunction and conjunction methods.</td></tr>
<tr><td>UNIT II
Indian medicinal plants
Some important Indian medicinal plants–tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai –uses.</td></tr>
</table>

	Common diseases and their treatment Causes, prevention and treatment of the following diseases: Insect borne diseases–malaria, filariasis, plague; Airborne diseases–diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases–cholera, typhoid, dysentery. Digestive system–jaundice; Respiratory system–asthma; Nervous system–epilepsy.
	Antibiotics Definition–classification–structure and therapeutic uses of chloramphenicol, penicillins, structure activity relationship of chloramphenicol; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.
	UNIT III **Drugs for major diseases** Cancer–common causes–chemotherapy–anti neoplastic agents - classification –adverse effects of cytotoxic agents; alkylating agents– chlorambucil; antimetabolites– methotrexate, fluouracil; Vinca alkaloids – vincristine, vinblastine.Diabetes– types – management of diabetes – insulin ; oral hypoglycemic agents - sulphonyl ureas – chlorpropamide; biguanides - metformin – thiazolidinediones. Cardiovascular drugs– cardio glycosides; anti arrhythmic agents – quinidine, propranolol hydrochloride; anti-hypertensive drugs - Aldomet, pentoliniumtartarate; vasodilator-tolazoline hydrochloride, sodium nitroprusside. AIDS – causes, Symptoms and prevention – anti HIV drugs - AZT, DDC.
	UNIT IV **Analgesics and antipyretic agents** Classification – action of analgesics – narcotic analgesics –morphine; synthetic analgesics – pethidine, methadone; antipyretic analgesics – salicylic acid derivatives, indolyl derivatives, p-aminophenol derivatives. **Anaesthetics** Definition, characteristics, classification - general anaesthetics – volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene– storage, advantages and disadvantages; non volatileanaesthetics – thiopental sodium; local anaesthetics – requisites – advantages- esters – cocaine, benzocaine; amides – lignocaine, cinchocaine. **Blood and haemotological agents** Blood– composition, grouping – physiological functions of plasma proteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, dry thrombin; Anti coagulants – coumarins, citric acid and heparin; antifibrinolytic agents – aminocaproic acid and tranexamic acid. Anaemia– causes, types and control – anti anaemic drugs.

	UNITV **Clinical Chemistry** Blood tests–blood count–complete haemotogram–Hb, RBC, GTT, TC, DC, platelets, PCV, ESR ; bleeding and clotting time–-glucose tolerance test.
	Significance of Clinical Tests Serum electrolytes-blood Glucose-ortho toluidine method**;** Renal
	Functions tests- blood urea, creatinine; liver function tests-serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile–cholesterol, triglycerides, HDL, LDL, coronary risk index. Urine examination– pH, tests for glucose, albumin and bile pigment.
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	1. JayashreeGhosh,(1999),Atextbookofpharmaceuticalchemistry,2nded.,S.Chand& company,NewDelhi. 2. LakshmiS,(2004),Pharmaceuticalchemistry,3rded.,Sultanchand &sons,Delhi. 3. TripathiKD,(2018),Essentialsofmedicalpharmacology,8thed.,Jaypeebrothersmedicalpublishers(P)Limited,NewDelhi. 4. AshutoshKar,(2018),Medicinalchemistry,7thed.,Newageinternational(P)Limited,Publishers,NewDelhi.
Reference Books	**Reference Books:** 1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I)6thed.,Himalayapublishinghouse,Bombay. 2. Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II).,Himalayapublishing house,Bombay. 3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva BooksPrivateLimited,NewDelhi. IntellectualPropertyRights,NeerajPandey,KhushdeepDharni.Publisher:PHILearningPvt.Ltd.,2014ISBN:812034989X,9788120349896.

Websiteand e-learningsource	1. http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf 2. http://www.indianmedicinalplants.info/ 3. https://www.wipo.int/about-ip/en/

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

CO1: Definethepharmaceuticalterminologies;describetheprinciplesin pharmacologicalactivity,drugdevelopment,clinicalchemistry,hematology, therapeuticdrugsandtreatmentofdiseases;listthetypesofIPRand trademarks.
CO2: Discussthedevelopmentofdrugs,structuralactivity,diseasetypes,physio-Chemicalpropertiesoftherapeuticagents,significanceofmedicinalplants,clinical testsandfactorsforpatentability.
CO3: Applytheprinciplesinvolvedinstructuralactivityanddrugdesigning,functionsofhaematologicalagents;estimationclinicalparametersandtherapeuticapplicationof drugsformajordiseases.
CO4: Explainclassificationofanalgesicsandanasthetics,andphysiologicalfunctionsof plasmaprotiens
CO5: Explain the significance of clinical tests like blood urea, serum proteins and coronaryriskindex

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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 PSOs	3.0	3.0	3.0	3.0	3.0

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 Course	**ORGANIC CHEMISTRY-II**						
Paper No.	**Core 13**						
Category	**Core Theory**	**Year**	III	**Credits**	4	**Course Code**	U23CHT613
		Semester	VI				
Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	5	1	-		6		
Prerequisites	Organic Chemistry–I						
Objectives of the course	This course aims at providing knowledge on • Classification, isolation and discussing the properties of alkaloids and terpenes. • Preparation and properties of saccharides • Biomolecules • Different molecular rearrangement • Preparation and properties of organometallic compounds						
Course Outline	**UNIT I** **Alkaloids** Classification, isolation, general properties-Hofmann Exhaustive Methylation; Structure elucidation–Coniine, piperine, nicotine. **Terpenes:** Classification, Isoprene rule, isolation and structural elucidation of Citral,alpha Terpineol, Menthol, Geraniol and Camphor.						

	UNIT II **Carbohydrates** Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples. **Monosaccharides**–configuration–D and L hexoses– aldohexoses and ketohexoses. Glucose, Fructose–Occurrence, preparation, properties, reactions, structural elucidation, uses. Inter conversions of sugar series–ascending, descending, aldose to ketose and ketose to aldose. **Disaccharides**–sucrose, lactose, maltose-preparation, properties and uses (no structural elucidation). **Polysaccharides**–Source, constituents and biological importance of homopolysaccharides-starch and cellulose, hetero polysaccharides–Hyaluronic acid, heparin.
	UNIT III **Molecular rearrangements:** Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement
	UNIT IV **Special reagents in organic synthesis** AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP, NBS/NCS, NMP, PCC. **Organo metallic compounds in Organic Synthesis** Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler–Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt
	UNIT V **Green Chemistry:** Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media–green solvents, green reagents and catalysts; tools used like microwave and ultra-sound in chemical synthesis.
Extended Professional Component(is a Part of internal Component only,	Questions related to the above topics, from various competitive Examinations UPSC /JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)

Not to be included In the external examination Question paper)	
Skills acquired From this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1 M.K.Jain, S.C.Sharma, Modern Organic Chemistry,VishalPublishing,4th reprint,2009. 2 S.M.Mukherji and S.P.Singh, Reaction Mechanism in Organic Chemistry,Macmillan India Ltd.,3rd edition,2009 3 ArunBahl and B.S.Bahl,Advanced organic chemistry, NewDelhi, S.Chand&Company Pvt.Ltd.,Multicolour edition,2012. 4 P.L.Soni and H.M.Chawla,TextBook of Organic Chemistry, Sultan Chand & Sons,NewDelhi,29th edition,2007. 5 C Bandyopadhya; An Insight into Green Chemistry; Published on 2020
Reference Books	1. R.T.Morrison and R.N.Boyd,Organic Chemistry, Pearson Education,Asia,6th edition,2012. 2. T.W.GrahamSolomons,Organic Chemistry,JohnWiley&Sons,11th edition,2012. 3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt.Ltd.,NewDelhi,7th edition,2009. 4. I.L.Finar,Organic Chemistry,Vol.(1&2),England,Wesley Longman Ltd,6th edition,2006. 5. J.A.Joule,andG.F.Smith,HeterocyclicChemistry,Wiley,5th Edition,2010.
Website and e-learning source	1.www.epgpathshala.nic.in2.www.nptel.ac.in3.http:/swayam.gov.in 2.VirtualTextbookofOrganicChemistry 3.https://vlab.amrita.edu/

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: Explain isolation and properties of alkaloids and terpenes.
CO2: Explain preparation and reactions of mono and disachharides.
CO3: Classify biomolecules and natural products based on their structure, properties, reactions and uses.
CO4: Explain molecular rearrangements like benzidine,Hoffmann etc.,
CO5: Preparation and properties of organolithium compounds

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

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICALCHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core-14</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Theory</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>U23CHT614</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>5</td><td>1</td><td colspan="2">-</td><td colspan="3">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Physical Chemistry-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of the
• Phase diagram of one and two component systems
• chemical equilibrium,
• Separation techniques for binary liquid mixtures.
• Electrical conductance and transport number.
• Galvanic cells, EMF and significance of electrochemical series.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I
Phase rule
Definition of terms, derivation of phase rule; application to one component systems – water and sulphur- super cooling, sublimation; two component systems – solid liquid equilibria- simple eutectic (lead –silver and bismuth-cadmium), (potassium iodide-water), compound formation with-congruent melting points(magnesium–zinc and ferric chloride–water system), peritectic change (sodium – potassium), solid solution (gold-silver); copper
sulphate – water system.</td></tr>
<tr><td></td><td colspan="7">UNIT II

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

	UNIT III **Electrical Conductance and Transference** Electrolytic conductance's -definition and determination-specific, equivalent conductance with dilution and its limiting values,strong and weak electrolytes, Theory of strong electrolytes– Arrhenius theory and its limitations -Debye Huckel theory–Onsager equation (no derivation), significance of Onsager equation, Ionic mobility , transport number – determination Hittorf's method, moving boundary method–factors affecting transport number–determination of ionic mobility; Kohlrausch's law-applications; applications of conductance measurements–determination of-degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water.
	UNITIV **Galvanic Cells and Applications** Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction,reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series–applications of electrochemical series.
	UNITV **Applications of EMF measurements** Applications of EMF measurements – determination of activity coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quin hydrone electrode and glass electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis; redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate.

Extended Professional Component (I s 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	1. B.R.Puri andL.R.Sharma,Principles of Physical Chemistry,Shoban Lal Nagin Chand andCo.,48 thedition,2021. 2. Peter Atkins,and Juliode Paula,JamesKeeler, Physical Chemistry,Oxford University press,International 11th edition,2018. 3. ArunBahl,B.S.Bahl,G.D.Tuli Essentials of physical chemistry,28thedition 2019,S,Chand&Co. 4. S.K.Dogra and S.Dogra,Physical Chemistry through Problems: New Age International,Fourth edition,1996. 5. J.Rajaram and J.C.Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and CO.,1986.
Reference Books	1. K.L. Kapoor,A Text book of Physical Chemistry,Macmillan India Ltd,3rd edition,2009. 2. Gilbert.W.Castellen,PhysicalChemistry,Narosa Publishing House, 3rd edition,1985. 3. P.W.Atkins,and Juliode Paula,PhysicalChemistry,Oxford University press,7th edition,2002. 4. B.R.Puri,L.R.Sharma and M.S.Pathania, Principles of Physical Chemistry,Shobanlal Nagin Chand and Co.Jalendhar, 41st edition,2001 5. D.N.Bajpai,Advanced Physical Chemistry,S.Chand&Co.,2001
Website and e-learning source	https://nptel.ac.in https://swayam.gov.in https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf /PPT s/MTS_07_m.pdf Thermodynamics - NPTEL https://www.youtube.com/watch?v=f0udxGcoztE Introduction to chemical equilibrium – MIT opencourse ware

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: Construct the phase diagram for one component and two component systems,explain the properties of freezing mixture,component with congruent melting points and solid solutions.

CO2: Apply the concepts of chemical equilibrium in dissociation of PCl_5, N_2O_4 and formation of HI,NH_3,$SO_3$and decomposition of calcium carbonate. Demonstrate important principles such as Le ,van't Hoff reaction isotherm and Clausius-Clayperon equation.

CO3: Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures,partially miscible mixtures an dimmiscible liquids.

CO4: Explain the significance of Arrhenius theory,Debye-Huckel theory,Onsager equation and Kohlrausch's law in conductance.

CO5: Construct electrochemical cell with the help of electrochemical series and calculate cell EMF.Demonstrate the applications of EMF and significance of potentiometric titrations.

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

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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 eof Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

<table>
<tr><td>Title of the Course</td><td colspan="7">PROJECT</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core 15</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Project (Group Project)</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">U23CH6PRO</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>1</td><td>1</td><td colspan="2">4</td><td colspan="3">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7"></td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of
• Creating environmental awareness
• Designing new problem and conducting research
• Consolidate the results and finding future perspectives.</td></tr>
</table>

<table>
<tr><td>Title of the Course</td><td colspan="7">NANO SCIENCE AND TECHNOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Subject Based Elective Course 7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective-7 Theory</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">U23CHE67A</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basics knowledge in physics and chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• Introduction to nano particles/clusters and nano composites
• Properties of nano materials
• Characterization of nano materials by different methods
• Synthesis of carbon nano tubes,graphene,quantumdots,self-assembled nanomaterials
• Applications of nano materials as sensors</td></tr>
</table>

Course Outline	**UNIT I** **Fundamentals of Nano science and Nano technology** Definitions, Relationship and Differences. Nano and Nature: Nanoscopic Colours (Butterfly Wings), Bioluminescence (Fire flies), Tribiology (Geckos sticky feet, lotus leaf effect). Introduction to hydrophilic and hydrophobic materials. Nanotechnology timeline, Pre-18th Century, 19th Century, 20th Century and 21st Century. Future perspectives of nano science and nanotechnology. **UNIT II** **Carbon Nanotubes** Carbon nanotubes – synthesis and purification -filling of nanotubes mechanism of growth – transport properties – mechanical properties – physical properties – application of carbon nanotubes. Preparation methods: Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition.
	UNIT III **Classification of Nanomaterials** Introduction to dimensional growth process. Classification of nanomaterials into 0D, 1D, 2D and 3D. Relationship between dimension and shape of nanomaterials (Quantum dots, Quantum wires, Carbon nanotubes, Bucky balls, Fullerenes). Introduction to size effect on electronic and optical properties (Quantum confinement).Properties of materials on a nanoscale

	UNIT IV **Core-shell** Nanoparticles -types of system – properties – application of core shell nanoparticles – monolayer protected metal nanoparticles method of preparation – functional metal nano particles – applications. Nanosensors – nanoscale organization for sensors – nanosensors on optical properties – physical properties – nanobiosensors – sensors of the future nanoshells – types of nanoshells – properties -applications
	UNIT V **Nanomedicines** Various kinds of nano system in use – protocols for nanodrug – administration – nanotechnology in diagnostic application. Use of gold nano- particles in diagnostic and therapeutic application molecular nanomachines -covalent and non-covalent approaches molecular motors and machines – molecular devices – practical problems with molecular devices.
Extended Professional Component (Is a part of internal component only, Not to be included in the external examination question paper	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/JAM/TNPSCotherstobesolved (TobediscussedduringtheTutorialhours)
Skills acquired From this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Sulabha K.Kulkarni, *Nanotechnology: Principles and Practices*, Capital Publishing Co.,NewDelhi. 2. Pradeep.T,*Nano:TheEssentials,Understanding Nanoscience and Nanotechnology*; Tata Mc Graw-Hill Publishing Company Limited,NewDelhi,2007. 3. Shah.M.A.;Tokeer Ahmad,*Principles of Nano science and Nanotechnology*;Narosa Publishing House,NewDelhi,2010. 4. Murthy.B.S, Shankar.P, BaldevRaj, Rath.B.B.James Murday,*Text book of Nanoscience and Nanotechnology*;Universities press,IndiaLtd,Hyderabad.2012.
Reference Books	1. Sharma.P.K.,*Understanding Nanotechnology*; Vista International Publishing House,Delhi.2008. 2. CharlesP.PooleJr, FrankJ.Owens. *Introduction to Nanotechnology;*A JohnWiley&Sons,INC.,Publication,2003. 3. ViswanathanB.,*NanoMaterials;*Narosa Publishing House,NewDelhi,2009. 4. Edited by C.N.R.Rao; Muller.A; Cheetham.A.K. *Nanomaterials Chemistry Recent Developments and New Directions*,WILEY-VCHVerlag GMBH &Co.,KGaA, Darmstad. JingZhongZhang,*Optical properties and spectroscopy of*

	Nanomaterials;World Scientific Publishing Pvt.Ltd.,Singapore.
Websiteand e-learningsource	1) http://www.nanotechnology.com/docs/wtd015798.pdf http://nccr.iitm.ac.in/Nanomaterials.pdf

Course Learning Outcomes (for Mapping with Pos and PSOs)
On completion of the course the students should be able to
CO1: Explain the general concepts of nanoscience.
CO2: Describe the preparation of nanotubes and their applications.
CO3: Describe the classification nanostructured materials and its application.
CO4:Describe the nanoparticles and nanosensors.
CO5: Discuss applications of nanomedicines.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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 PSOs	3.0	3.0	3.0	3.0	3.0

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

<table>
<tr><td>Title of the Course</td><td colspan="7">POLYMERSCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="7">Subject Based Elective Course 7</td></tr>
<tr><td>Category</td><td>Elective 7 Theory</td><td>Year
Semester</td><td>III
VI</td><td>Credits</td><td>3</td><td>Course Code</td><td>U23CHE612</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture
4</td><td>Tutorial
1</td><td colspan="3">Lab Practice
-</td><td>Total
5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Knowledge on functional groups and reaction mechanisms</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of
• Classification of polymers, preparation of polymers.
• Thermoplastics and thermosetting polymers
• Rubber.
• Weight determination of polymer and polymerization Techniques.
• Inorganic polymers.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNITI
Introduction
Introduction – Monomers, Oligomers, Polymers and their characteristics-Degree of polymerization- Functionality of polymer-Classification of polymers-addition polymers – PVC, orlon, Condensation polymers – Definition, Dacron, Nylon 6-Nylon 6,6 – preparation properties, uses – copolymers – preparation, properties and uses of saron. Mechanism of addition polymerization – free radical polymerization – ionic polymerization.</td></tr>
<tr><td></td><td colspan="7">UNIT II
Thermoplastics and Thermosetting
Introduction of Thermoplastics and thermosetting polymers. Thermoplastics- difference between thermoplastic and thermosetting: Preparation, Properties and Uses of Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Polytetrafluoro ethylene, nylon and polyester. Thermosetting Plastics: Phenol formaldehyde and epoxide resin. Biodegradable Polymers.
UNIT III
Rubber
History of Rubber- Elastomers or Rubber – natural rubber – compounding of rubber, properties, uses, synthetic rubbers – buna-s neoprene, silicone rubber. Preparation, Properties and use of Conducting Polymers, examples: poly sulphur nitriles, poly phenylene, polypyrrole and poly acetylene.</td></tr>
</table>

	UNIT IV **Weight determination of polymer and polymerization Techniques** The nature and structure of polymers-structure property relationships weight determination – number average, weight average methods of determination – osmotic pressure, viscosity, light scattering methods. Polymerization Techniques: Bulk, Solution, Suspension and Emulsion.
	UNIT V **Inorganic Polymers** Introduction of Inorganic polymers – Classification of Inorganic Polymers- Homo-atomic polymer-Hetero-atomic polymer – general properties of Inorganic polymers – glass transition temperature classification – polymer containing boron -preparation, properties and uses of Boron Nitride, Borazine, silicone rubber.
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	1. GowarikerV.R, N.V.Viswanthan and Jayadev Sreedhar.Polymer Science,NewDelhi:New Age International,2015 2. MisraG.S.Introductory PolymerChemistry,NewDelhi:WileyEastern,2010. 3. Bahadur P and Sastry N V,Principles of Polymer Science, NewDelhi: Narosa Publishing House,2005 4. Ahluwalia,V.K.Anuradha Mishra,*Polymer Science A TextBook*,Ane Books India,NewDelhi,2008. 5. Morrison,R.R.;Boyd,R.N.; Bhattacharjee,S.K.*Organic Chemistry*,7th ed.; Pearson:NewDelhi,2011.
Reference Books	1. Billmeyer F.W.Polymer Science,India,Wiley-Interscience,2007. 2. Seymour, R. B.; Carraher Jr.C.E. *Polymer Chemistry: An Introduction,* Marcel Dckker Inc:NewYork,1981. 3. Sinha,R.*Outlines of Polymer Technology*, Prentice Hall of India: New Delhi,2000. 4. JoelR.Fried,*PolymerScienceandTechnology*,3rded.;Prentice Hall of India:NewDelhi,2014.

Website and e-learning source	1. https://polymerdatabase.com 2. http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=13.http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.htm4.http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weights+of+polymers.pdf

Course Learning Outcomes (for Mapping with Pos and PSOs)
On completion of the course the students should be able to
CO1: Explain classification of polymers and mechanism of polymerization
CO2: Differentiate thermoplastic and thermosetting polymers.
CO3: Describe elastomers.
CO4: Demonstrate molecular weight determination and polymerization techniques of polymers.
CO5: Describe inorganic polymers.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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 PSOs	3.0	3.0	3.0	3.0	3.0

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 Course	**DAIRY CHEMISTRY**						
Paper No.	**SUBJECT BASED ELECTIVE 8**						
Category	**Elective 8 Theory**	**Year**	III	**Credits**	3	**Course Code**	U23CHE68A
		Semester	VI				
Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	4	1	-			**5**	
Prerequisites	Higher secondary chemistry						
Objectives of the course	This course aims at providing an overall view of the • Chemistry of milk and milk products • Processing of milk • Preservation and formation of milk products.						
Course Outline	**UNIT I** **Composition of Milk** Milk-definition-generalcompositionofmilk-constituentsofmilk-lipids,proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour,odour,acidity,specificgravity,viscosityandconductivity-Factors affecting the composition of milk-adulterants, preservatives with neutralizer-examples and their detection-estimation of fat,acidity and total solids in milk. **UNIT II** **Processing of Milk** Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing-boiling,pasteurization– types of pasteurization-Bottle, Batch and HTST (HighTemperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization. **UNIT III** **Major Milk Products** Cream-definition-composition-chemistry of creaming process gravitational and centrifugal methods of separation of cream-estimation of fat in cream. Butter - definition -composition - theory of churning – desi butter -salted butter, estimation of acidity and moisture content in butter. Ghee – major constituents-common adulterants added to ghee and their detection-rancidity-definition-prevention-antioxidants and synergists-natural and synthetic. **UNIT IV** **Special Milk** Standardized milk-definition-merits-reconstituted milk-definition-flow diagram of manufacture-Homogenized milk-flavoured milk-vitaminised milk-toned milk-Incitation milk-Vegetable toned milk- humanized milk– condensed milk - definition, composition and nutritive value. **UNIT V** **Fermented and other Milk Products** Fermented milk products-fermentation of milk-definition, conditions, cultured milk-definition of culture-example, conditions-cultured cream, buttermilk-Bulgarious milk-acid opinlous 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.						
Recommended Text	1. K.Bagavathi Sundari, Applied Chemistry, MJP Publishers,1st edition,2006. 2. K.S.Rangappa and K.T.Acharya, Indian Dairy Products ,Asia Publishing House New Delhi,1974. 3.Text book of dairy chemistry, M.P.Mathur, D.DattaRoy, P. Dinakar, ,1st edition,2008. 4. AText book of dairy chemistry, Saurav Singh,Daya Publishing house,1st edition,2013. 5. Text book of dairy chemistry, P.L.Choudhary,Bio-Green book publishers,2021.						
Reference Books	1. Robert Jenness and S.Patom,Principles of Dairy Chemistry,S.Wiley,NewYork,2005. 2. F.P.Wond,Fundamentals of Dairy Chemistry,Springer,Singapore,2006. 3. Sukumar De,Out lines of Dairy Technology,Oxford University Press,New Delhi,1980. 4. P.F.Fox and P.L.H.Mc sweeney,Dairy Chemistry and Biochemistry,Springer,Second edition,2016. 5. Dairy chemistry and biochemistry,P.F.Fox,T.Uniacke-Lowe,P.L.H. McSweeney,J.A.OMahony,Springer 2nd edition,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

CO1: Understand about general composition of milk–constituents and its physical properties.
CO2: Acquire knowledge about pasteurization of Milk and various types of pasteurization-Bottle, Batch and HTST Ultra High Temperature Pasteurization.
CO3: Learn about Cream and Butter their composition and how to estimate fat in cream and Ghee
CO4: Explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.
CO5: Have an idea about how to make milk powder and its drying process-types of drying process

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

CO-PO Mapping (Course Articulation Matrix)

CO/PO	PSO 1	PSO 2	PSO 3	PSO 4	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

Level of Correlation between PSO's and CO's

<table>
<tr><td>Title of the Course</td><td colspan="7">TEXTILE CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">SUBJECT BASED ELECTIVE 8</td></tr>
<tr><td>Category</td><td>Elective 8 Theory</td><td>Year
Semester</td><td>III
VI</td><td>Credits</td><td>3</td><td>Course Code</td><td>U23CHE68B</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture
4</td><td>Tutorial
1</td><td colspan="2">Lab Practice
-</td><td colspan="3">Total
5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Previous core papers</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• To facilitate the students to learn about the pre-treatments of various kinds of textile materials involved in textile wet processing industries.
• To acquire knowledge of natural fibers
• To get basic importance of dying process
• To understand the basic concept of printing methods</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I
Unit – I - Natural Fiber
Properties of textile fiber – classification of fibers. Natural fibers of vegetables origin – chemical and physical properties of cotton, jute. Natural fibers of animal origin: chemical and physical properties of wool and silk – natural mineral fibers: chemical and physical properties of asbestos and glass.</td></tr>
<tr><td></td><td colspan="7">UNIT II
Man made fiber
Mode of production – types of spinning – wet dry and melt spinning.
a. viscose rayon: Raw material, method of conversion to fiber and filament form. Physical and chemical properties and uses.
b. Cuprammonium rayon and cellulose acetate: raw materials, method of conversion to fiber and filament form. Physical and chemical properties and uses.
c. Synthetic organic fiber: polyamide and polyester fiber – raw materials, method of production, physical and chemical properties fiber structure.

UNIT III
Dyeing
Dyeing: classification of dyes – theories of dyeing
Direct dye: properties, method of application to cotton – assistants used and their functions. Sulphur dye: properties, method of application to cotton. Acid dye: properties, method of application to cotton.
Vat dye: properties, method of application to cotton.</td></tr>
</table>

	UNIT IV **Pre-treatment process of dyeing** Introduction and Pre – treatment process for dyeing-process sequence in pretreatment processing- singeing –singeing process sequence, yarn singeing, desizing, Oxidative desizing, scouring, Basic surfactant concepts, and bleaching -introduction of bleaching, bleaching with sodium chlorite.
	UNIT V **Printing Process** Printing Process-Historical Perspective-Methods Used for printing-Block Printing method- stencil method-machine roller printing-screen printing method-semi automated process- Finishing Process- Chemical Finishing Process-Applications of Printing -different methods of printing like hand block printing, stencil printing, wax printing, screen printing, roller printing etc.
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	**Text Books** 1.K.Venkatraman,"TheChemistryofSyntheticDyes"–Vol.III,Academicpress,London,2010. 2.Robert RMather,RogerHWardman,The ChemistryofTextile Fibers, RoyalSocietyofChemistry,2nd Edition,2015.
Reference Books	**Reference Books** 1.David. R. Waring, Geoffrey Hallas, The Chemistry and Application of Dyes, Springer-Verlag New York Inc. 2012. 2.V. A. Shenai, "Technology of Textile Printing," 2nd Edition, Sevak Publisher, 2003.
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

CO1: Explain the importance of Natural Fibers and their applications to natural fiber.
CO2: Explain the Man- made fiber and its types.
CO3: Demonstrate pre-treatment of processing of dyes.
CO4: Explain the theory and classify dyes.
CO5: Explain the different methods of printing processes.

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

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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

SUBJECT BASED ELECTIVE (ALLIED)

Title of the Course	**ALLIED CHEMISTRY FOR PHYSICAL SCIENCES AND BIOLOGICAL SCIENCES**
Paper No.	**Subject Based Elective (Allied)**

<table>
<tr><td>Category</td><td>Allied Theory</td><td>Year
Semester</td><td>II
III</td><td>Credits</td><td>3</td><td>Course Code</td><td>U23CHEA33</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture
4</td><td>Tutorial
-</td><td colspan="2">Lab Practice</td><td colspan="2">Total
4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
• Handling of chemicals and data analysis.
• Concepts of chemical bonding.
• Principles of volumetric analysis.
• Concepts of kinetics.
• Concepts of thermodynamics.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNITI

Handling of Chemicals and Data Analysis
Storage and handling of chemicals: Handling of acids, ethers, toxic chemicals. Antidotes, threshold vapour concentration and first aid procedure.
Errors in chemical analysis: Accuracy, precision. Types of error-absolute and relative errors.Methods of eliminating and minimizing errors.
Separation techniques–Solvent extraction. Principle of adsorption and partition chromatography, column chromatography, thin layer chromatography (TLC), paper chromatography and their applications.

Unit II
Chemical Bonding
Ionic Bond: Nature of Ionic bond. Structure of NaCl, KCl and CsCl. Factors influencing the formation of ionic bond.
Covalent Bond: Nature of covalent bond. Structure of CH4, NH3, H2O based on hybridisation.
Coordinate Bond: Nature of coordinate bond. Coordination complexes.Werner’stheory.Geometrical and optical isomerism in square planar and octahedral complexes.
Mention of structure and functions of chlorophyll and hemoglobin
Hydrogen Bond: Theory and importance of hydrogen bonding. Types of hydrogen bonding.Hydrogen bonding in carboxylic acids, alcohol, amides, polyamides, DNA and RNA.</td></tr>
</table>

	UNIT III **Volumetric Analysis** Methods of expressing concentration: normality, molarity, molality, ppm. Primary and secondary standards: preparation of standard solutions Principle of volumetric analysis: end point and equivalence points. Strong and weak acids and bases - Ionic product of water, pH, pKa, pKb. Buffer solutions-pH of buffer solutions. Mention of Henderson equation & its significance.
	UNIT IV **Thermodynamics and Chemical Kinetics** Introduction: Scope and importance of thermodynamics- system and surrounding-isolated, closed and open systems- state of the system-intensive and extensive variables. Thermodynamic process- reversible and irreversible, isothermal and adiabatic process. Chemical Kinetics: Rate, rate law, order and molecularity. Derivation of rate expressions for I and II order reactions. Catalysis-Homogeneous and heterogeneous catalysis. Enzyme catalysis, enzymes in biological system and in industry.
	UNIT V **Chemistry of Biomolecules** Fats – Occurrence and composition. Hydrolysis of fats. Vitamins – Source, provitamin, properties and classification. Structure and functionof vitamin A, C, D, K and E Hormones– Thyroxin, and adrenaline (structure and functions only) .

Extended Professional Component(is a Part of internal Component only, Not to be included In the external examination question paper) Skills acquired From this course	Questions related to the above topics, from various competitive Examinations UPSC/JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)
	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V.Veeraiyan,TextbookofAncillaryChemistry;Highmountpublishinghouse,Chennai,firstedition,2009. 2. S.Vaithyanathan,TextbookofAncillaryChemistry;PriyaPublications,Karur,2006. 3. S.ArunBahl,B.S.Bahl,AdvancedOrganicChemistry;S.ChandandCompany,NewDelhi,twentythirdedition,2012. 4. P.L.Soni,H.M.Chawla,TextBookofOrganicChemistry;Sultan Chand& Sons,NewDelhi,twentyninthedition,2007.
Reference Books	5. P.L.Soni,MohanKatyal,TextbookofInorganicchemistry;SultanChandandCompany,NewDelhi,twentiethedition,2007. 6. B.R.Puri,L.R.Sharma,M.S.Pathania,TextbookPhysicalChemistry;VishalPublishingCo.,NewDelhi,forty seventhedition,2018. 7. B.K,Sharma,IndustrialChemistry;GOELpublishinghouse,Meerut, sixteenth edition,2014.
Course Learning Outcomes (for Mapping with POs and PSOs) **On completion of the course the students should be able to**	

CO 1: handle the chemicals and first aid procedures**.**
CO 2: gain in-depth knowledge about the theories of chemical bonding,
CO 3: explain the principles of volumetric analysis.
CO 4: explain the concepts of chemical kinetics.
CO 5: explain various thermodynamic principles.

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**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

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

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED CHEMISTRY PRACTICAL FOR PHYSICAL SCIENCES AND BIOLOGICAL SCIENCES</td></tr>
<tr><td>Paper No.</td><td colspan="7">Subject Bases Elective (Allied)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied Practical</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">CourseCode</td><td rowspan="2">U23CHEA44</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>-</td><td>-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7"></td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on the
• Basics of preparation of solutions.
• Principles and practical Experience of volumetric analysis</td></tr>
<tr><td>Course Outline</td><td colspan="7">VOLUMETRIC ANALYSIS:
1. Estimation of Sodium hydroxide using standard Sodium carbonate.
2. Estimation of Hydrochloric acid using standard Oxalic acid.
3. Estimation of Ferrous sulphate using standard Mohr’s salt.
4. Estimation of Oxalic acid using standard Ferrous sulphate.
5. Estimation of Potassium Permanganate using standard Sodium hydroxide.
6. Estimation of Magnesium using EDTA.
7. Estimation of Ferrous ion using Diphenylamine as indicator.</td></tr>
<tr><td>Reference Books</td><td colspan="7">V.Venkateswaran,R.Veerasamy,A.R.Kulandaivelu,BasicPrinciplesofPracticalChemistry;SultanChand&sons,Secondedition,1997.</td></tr>
<tr><td colspan="8">CourseLearningOutcomes(forMappingwithPOsandPSOs)Oncompletionofthecoursethestudentsshouldbeableto
CO1:To gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO2:To design, carryout, record and interpret the results of volumetric titration.
CO3:To apply their skill in the analysis of water/hardness.
CO4:To analyze the chemical constituents in allied chemical products</td></tr>
</table>

SUBJECT ENHANCEMENT COURSE – NON-MAJOR ELECTIVE

<table>
<tr><td>Title of the Course</td><td colspan="7">COSMETIC CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">NME (Subject Enhancement Course)</td></tr>
<tr><td>Category</td><td>NME Theory</td><td>Year
Semester</td><td>II
III</td><td>Credits</td><td>2</td><td>Course Code</td><td>U23CHS304</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture
2</td><td>Tutorial
-</td><td colspan="2">Lab Practice
-</td><td colspan="2">Total
2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge
• Describe the types of cosmetics. skin types, skin care products and role of calcium in the regulation of skin barrier homeostasis skin pH and skin flora.
• To know more about the cosmetics natural and artificial,
• To obtain adequate knowledge and scientific information regarding basic principles of cosmetic chemistry.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNITI
INTRODUCTION
Cosmetics-Types – liquid or emulsions, anhydrous creams or sticks – Ingredients - Natural and mineral.
Skin types – Sensitive skin – Hydrating substances –skin care products - Role of calcium in the regulation of skin barrier homeostasis- skin pH and skin flora.</td></tr>
<tr><td></td><td colspan="7">UNIT II
Natural Perfumes and Artificial Perfumes and flavors
Perfumes –plant and animal sources– examples –components of perfume – vehicle – characteristics of good vehicle -fixatives and its types, odoriferous compounds- Composition and preparation of rose and jasmine perfumes – manufacture of fruit flavors – fruit syrup preparation and composition of apple and pineapple flavors.</td></tr>
<tr><td></td><td colspan="7">UNIT III
Hair Care Products
Shampoos – principal constituents – thickeners and foam stabilizers – perfumes – preservatives – conditioning agents – antidandruff shampoos. Hair cream – composition – hair dyes – types – constituents – dye removals.

Skin Care Product
Skin cleansers – classifications – cold cream – cleansing milk – moisturizers – hand and body lotions – sun screen lotions – constituents</td></tr>
<tr><td></td><td colspan="7">UNIT- IV
Soaps and Detergents
Cleansing action of soap – differences between soap and detergents – ingredients and preparation of washing and bathing soap – TFM of bathing soap – composition of solid and liquid detergents – functions of ingredients in detergents.
UNIT- V
Colour Cosmetics
Lipstick – constitutions – manufacturing method – lip glosses – nail polish – formulation – manufacture – face powder – constitution.</td></tr>
</table>

	Dental Product Oral care product – product categories – toothpaste – toothpowder – oral rinses – mouth washes.
Extended Professional Component (is a Part of internal Component only, Not to be included In the external examination question paper) Skills acquired From this course	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours) Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Ramesh Kumari, Chemistry of Cosmetics, Prestige Publishers, 2018. 2. R. K. Nema, Textbook of Cosmetics, CBS, Publisher, 2017. 3.
Reference Books	1.M. Vimaladevi, Textbook of Cosmetic, CBS Publisher, 2019. 2. Heather A. E. Benson, Michael S. Roberts, Vania Rodrigues Leite-Silva, Kenneth Walters, Cosmetic Formulation: Principles and Practice, CRC Press Publisher, 2021.

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

CO 1: describe the types of cosmetics. skin types, skin care products and role of calcium in the regulation of skin barrier homeostasis skin pH and skin flora.

CO 2:Choose cosmetics upon checking harmless chemical ingredients from various products

CO 3: discuss the basic idea about colourcosmetics

CO 4: explain the procedures of dental product and bath product.

CO 5: explainthe preparation of perfume and flavours.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	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 PSOs	3.0	3.0	3.0	3.0	3.0

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

SUBJECT ENHANCEMENT COURSE – NONMAJOR ELECTIVE

<table>
<tr><td>Title of the Course</td><td colspan="7">APPLIED CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">NME (Subject Enhancement Course)</td></tr>
<tr><td>Category</td><td>NME Theory</td><td>Year
Semester</td><td>II
IV</td><td>Credits</td><td>2</td><td>Course Code</td><td>U23CHS405</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture
2</td><td>Tutorial
-</td><td colspan="2">Lab Practice
-</td><td colspan="3">Total
2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course provides knowledge
• to understand the preparation and properties of Rubber and Fibers
• to understand the preparation and properties of Plastics and Resins. 3.To know the classification and importance of Fertilizers
• to understand the use of chemicals in improvement of agricultural crops</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT – I
Elastomers
Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene. Rubber: Types-defects in natural rubber-vulcanization-synthetic rubbers- uses of neoprene, thiocol, silicone rubber and foam rubber.</td></tr>
<tr><td></td><td colspan="7">UNIT – II
Fibers
Definition, natural and synthetic fibers:Natural fibers (cellulosic and protenious) –Semi synthetic (Rayon) Synthetic fibers (Poly ester, Nylon and Acrylic) –Pretreatment of fibers (Sizing, Desizing, Bleaching).</td></tr>
<tr><td></td><td colspan="7">UNIT III
Resins
Natural and synthetic resins – distinction between resins and plastics, action of ion exchange resins,separation of inorganic mixtures,applications,phenol-formaldehyde resins -amino resins-urea- formaldehyde and melamine-formaldehyde resins-polyurethanes -epoxy resins.</td></tr>
<tr><td></td><td colspan="7">UNIT- IV
Plastics
Classification- differences between thermoplastics and thermosetting polymers. Advantages of plastics-preparation, properties and uses of polythene, PVC, polystyrene, Teflon and PAN.

UNIT- V
Fertilizer
Definition-characteristics of a good fertilizer- role of nitrogen, potassium and phosphorous in plant growth – natural fertilizers- chemical fertilizers: urea, muriatic of potash and triple superphosphate - mixed fertilizers – biofertilizers – advantages of biofertilizers.</td></tr>
</table>

Extended Professional Component (is a Part of internal component only, Not to be included In the external examination question paper) Skills acquired From this course	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours) Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1.B. S. Chauhan, Applied Chemistry, Vayu Education India, 2013. 2.B. K. Sharma, Industrial Chemistry Krishna Prakasha Media(p) Ltd., 2011
Reference Books	1.B.S Chauhan, Applied Chemistry,Vayu Education of India, 2013. 2.K. BagavathiSundari, "Applied Chemistry" MJP Publishers, 2006.
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to **CO 1**: explain the Natural and synthetic rubber composition. **CO 2**: differentiate natural and artificial fibers. **CO 3:** describe the distinction between resins and plastics. **CO 4**: remember the classification of plastics and properties. **CO5**: appreciate the importance of fertilizers.	

O/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**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 PSOs	3.0	3.0	3.0	3.0	3.0

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