KAMARAJ COLLEGE

(AUTONOMOUS)
Accredited with A+ Grade by NAAC
Among Top 150 Colleges in India - NIRF Ranking 2025
இந்து நாடார் சங்கங்களால் 1966-ல் தொடங்கப்பட்ட கல்லூரி
(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)
THOOTHUKUDI - 628 003.

B.Sc., Chemistry

Semester - I to VI

(for the students those who joined from the academic year 2024-2025)

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SYLLABUS

(for the students those who joined from the academic year 2024-2025)

Department Profile

Name of the Programme	B.Sc., Chemistry
Programme Code	03003
Year of Establishment	1967

Vision

To make the students excel in the fields of education, fundamental and advanced research in Chemistry by providing quality education so that they can compete and contribute to the varying technology.

Mission

- To teach the students to analyze problems ranging from the basics of Chemistry to advanced level.
- To give the students adequate hands on experience to work in applied fields.
- To train the students to act as a useful member or effective leader of a team in multidisciplinary setting

College Mail ID	kamarajcoll@gmail.com
College Website	www.kamarajcollege.ac.in

Undergraduate Degree Programme

1. Introduction

Programme Outcome, Programme Specific Outcomes and Course Outcomes. Students completing this programme will be able to present their core under- graduated is cipline clearly and precisely, make abstract ideas precise by formulating them in the language of the specific discipline, describe related ideas from multiple perspectives and explain fundamental concepts. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in various other public and private enterprises.

Eligibility: +2 course with Mathematics, Physics and Chemistry (Or) Physics, Chemistry and Biology

Learning Outcomes-Based Curriculum Frame work Guidelines Based Regulations for Under Graduate Programme	
Programme:	B.Sc. (Chemistry)
Programme Code:	03003
Duration:	3 Years (UG)
Programme Outcomes	
PO1	**Disciplinary knowledge**: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an Undergraduate Programme of study.
PO2	**Communication Skills**: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
PO3	**Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
PO4	**Problem solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

PO5	**Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
PO6	**Research-related skills:** A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation
PO7	**Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team
PO8	**Scientific reasoning:** Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

Programme Specific Outcomes On successful completion of Bachelor of (Chemistry) programme, the student should be able to:	
PSO1	Disciplinary Knowledge:
PSO2	Critical Thinking:
PSO3	Problem Solving
PSO4	Analytical & Scientific Reasoning:
PSO5	Research related skills:

Methods of Assessment	
Recall(K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, summary or overview
Application(K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
Analyze(K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate Between various ideas, Map knowledge
Evaluate(K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons
Create(K6)	Check knowledge in specific or off beat situations, Discussion, Debating or Presentations

Methods of Evaluation			Marks
Internal Evaluation	Continuous Internal Assessment Test	**15**	**25**
	Assignment (PPT) and Seminar	**5**	
	Group Discussion and Viva	**5**	
External Evaluation	End Semester Examination		**75**
	Total		**100**

Extra Credits

Curricular Activities	Co-Curricular Activities	Extra-Curricular Activities
Paper Presentation	Cultural Competitions	NCC
Paper Publication	Domain Clubs	NSS
Placement Training		Sports
Quiz		YRC
Competitions		UBA
SWAYAM /NPTEL/MOOCs		

Level	Credit			
	Participation	III Prize	II Prize	I Prize
Intra college	1	2	3	4
Intercollegiate	2	3	4	5
District	3	4	5	6
University	4	5	6	7
State	5	6	7	8
National	6	7	8	9
International	7	8	9	10

****Paper Presentation for each paper: 1credit**

Total credits Under–Graduate Courses including Lab Hours – 2024 to 2025

Semester	Hours	Credits	Additional Credits
I	30	22	2
II	30	22	2
III	30	22	2
IV	30	23	2
V	30	28	3
VI	30	23	3
Total		**140**	**14**

**Extra Credit will be given on the basis of student's performances

Written Examination: Theory Paper (Bloom's Taxonomy based) Question paper Model Assessment Pattern

Continuous Internal Assessment (CIA) & End Semester Examination (ESE)

- CIA : 25
- ESE: 75

Theory Course:

For theory courses there shall be two tests conducted by the faculty concerned and the average of the two can be taken as the Continuous Internal Assessment (CIA).CIA is for 30 marks max and will be converted in to 15 marks. The duration of each test shall be 1 ¼ Hrs.

Continuous Internal Assessment (Writing)	15 marks
Assignment (PPT) & Seminar	5 marks
Viva & Group Discussion	5 marks

For theory Papers:

- Part A (10×1=10) Marks-Answer all questions (Multiple choice)
- Part B (5×5=25) Marks-Choosing either(a) or (b)
- Part C (5×8=40) Marks-Choosing either (a) or (b)

  Total =75marks

Laboratory Courses Assessment

- CIA-40marks
- ESE-60marks
- Mandatory Record submission, attendance and class participation.
- Two CIA for 40 marks max. The average of the best two can be taken as the Continuous Internal Assessment.
- The duration of each test shall be 3 hours. In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum. The S, M, L is based on the Course outcomes. The mapping is based on the revised Bloom's

Taxonomy Verbs used to describe your Course outcomes.

- Remember and Understanding–Lower level
- Apply and Analyze– Medium Level
- Evaluate and Create–Strong Level

Pedagogy:

- Technology Based Learning (PPT)
- Peer Teaching (Chalk & Talk)
- Virtual Lab
- Blended Learning (Online & Offline)
- Group Learning
- Self - Study
- Games Based Learning

Course Structure for Science Stream

First Year – Semester I
B.Sc., Chemistry
(With effect from the academic year 2024 to 2025 onwards)

Semester I	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	24ULTL11	இலக்கிய வரலாறு - I	6	3	3	25	75	100
Part - II	24ULEN11	General English - I	6	3	3	25	75	100
Part - III Core - I	24UMCH11	General Chemistry-I	5	5	3	25	75	100
Core - I Lab	24UMCHL1	Quantitative Inorganic Estimation	3	2	3	40	60	100
EC - I Discipline /Generic (Any one)	24UEMA11	Allied: Mathematics Paper-I Algebra and Differential Equations	6	5	3	25	75	100
	24UEZO11	Allied: Zoology Paper-I	4	3	3	25	75	100
	24UEZOL1	Allied: Zoology Practical-I	2	2	3	40	60	100
Part - IV SEC - I	24USCH11	Food Chemistry	2	2	3	25	75	100
FC	24UFCH11	Foundation Course in Chemistry	2	2	3	25	75	100
Total			**30**	**22**				

**SEC-Skill Enhancement Course **CIA-Continuous Internal Assessment
**EC–Elective Course **ESE-End Semester Examination
**FC -Foundation course

Course Structure for Science Stream
First Year – Semester II
B.Sc., Chemistry
(With effect from the academic year 2024 – 2025 onwards)

Semester II	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	24ULTL21	தமிழ் இலக்கிய வரலாறு - II	6	3	3	25	75	100
Part - II	24ULEN21	General English – II	6	3	3	25	75	100
Part - III Core - II	24UMCH21	General Chemistry-II	5	5	3	25	75	100
Core - II Lab - 2	24UMCHL2	Preparation of organic and inorganic compounds and determination of physical constants	3	2	3	40	60	100
EC - II Discipline /Generic (Select any one)	24UEMA21	Allied Mathematics Paper-II Vector Calculus & Fourier Series	6	5	3	25	75	100
	24UEZO21	Allied Zoology paper-II	4	3	3	25	75	100
	24UEZOL2	Allied Zoology practical-II	2	2	3	40	60	100
Part - IV SEC - II	24USCH21	Dairy Chemistry	2	2	3	25	75	100
SEC - III	24USCH22	Role of Chemistry in daily life	2	2	3	25	75	100
		Total	**30**	**22**				

**** SEC-Skill Enhancement Course** **** CIA- Continuous Internal Assessment**
**** EC –Elective Course** **** ESE- End Semester Examination**

Course Structure for Science Stream
Second Year – Semester III
B.Sc., Chemistry
(With effect from the academic year 2024 to 2025 onwards)

Semester III	Course Code	Title of the Course	Hours / Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part- I	24ULTL31	தமிழக வரலாறும் பண்பாடும்	6	3	3	25	75	100
Part- II	24ULEN31	General English - III	6	3	3	25	75	100
Part -III Core -III	24UMCH31	General Chemistry-III	5	5	3	25	75	100
Core -III Lab-3	24UMCHL3	Qualitative inorganic analysis (mixture)	3	2	3	40	60	100
EC- III Discipline /Generic Lab - 1	24UEPH11	Allied: Physics Paper – I	4	3	3	25	75	100
	24UEPHL1	Allied Physics Practical-I	2P	2	3	40	60	100
Part-IV SEC- IV	24USCHL1	Entrepreneurial skills in Chemistry	2P	2	3	40	60	100
Part - IV	24UYOG31	Yoga, Culture & Heritage	2	2	1.5	25	75	100
		Total	**30**	**22**				

**** SEC-Skill Enhancement Course**

****EC –Elective Course**

****CIA- Continuous Internal Assessment**

**** ESE- End Semester Examination**

Course Structure for Science Stream
Second Year – Semester - IV
B.Sc., Chemistry
(With effect from the academic year 2024 – 2025 onwards)

Semester IV	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	24ULTL41	தமிழும் அறிவியலும்	6	3	3	25	75	100
Part - II	24ULEN41	General English - IV	6	3	3	25	75	100
Part - III Core - IV	24UMCH41	General Chemistry-IV	5	5	3	25	75	100
Core - IV Lab	24UMCHL4	Qualitative organic analysis	3	2	3	40	60	100
EC - IV Discipline /Generic	24UEPH41	Allied: Physics Paper – II	4	3	3	25	75	100
	24UEPHL2	Allied Physics Practical-II	2	2	3	40	60	100
Part - IV SEC - V	24USCH41	Instrumental methods of chemical analysis	2	2	3	25	75	100
Part - IV	24UEVS41	Environmental Studies	2	2	3	25	75	100
Part - V	24UEA41	NCC/ NSS/ YRC/ SPORTS	-	1				
		Total	**30**	**23**				

**** SEC-Skill Enhancement Course** **** CIA- Continuous Internal Assessment**
**** EC –Elective Course** **** ESE- End Semester Examination**

Course Structure for Science Stream
Third Year – Semester - V
B.Sc., Chemistry
(With effect from the academic year 2024 – 2025 onwards)

Semester V	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Core - V	24UMCH51	Organic Chemistry-I	5	5	3	25	75	100
Core - VI	24UMCH52	Inorganic Chemistry–I	5	5	3	25	75	100
Core - VII	24UMCH53	Physical Chemistry–I	6	5	3	25	75	100
Core -V Lab - 5	24UMCHL5	Physical Chemistry Practical	4	3	5	40	60	100
EC - V (select any one)	24UECH51 24UECH52	1. Biochemistry 2. Nano Science	4	3	3	25	75	100
EC - VI (select any one)	24UECH53 24UECH54	1. Industrial Chemistry 2. Pharmaceutical Chemistry	4	3	3	25	75	100
Part - IV Training	24UINT51	*Internship	-	2	1.5	50	50	100
Part - V	24UPDT51	Personality Development	2	2	3	25	75	100
		Total	**30**	**28**				

****SEC- Skill Enhancement Course** ****CIA- Continuous Internal Assessment**

****EC– Elective Course** ****ESE- End Semester Examination**

***Internship – course duration - 7 to14 days (Report should be submitted & Viva Voce will be conducted for the report which is equivalent to the project Viva – voce).**

Course Structure for Science Stream
Third Year – Semester – VI
B.Sc., Chemistry
(With effect from the academic year 2024 – 2025 onwards)

Semester VI	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Core - VIII	24UMCH61	Organic Chemistry-II	5	4	3	25	75	100
Core - IX	24UMCH62	Inorganic Chemistry–II	5	4	3	25	75	100
Core - X	24UMCH63	Physical Chemistry–II	5	4	3	25	75	100
Core Project	24UMCHP1	Group Project with viva-voce	5	3	1.5	50	50	100
EC - VII (select any one)	24UECH61 24UECH62	1. Fundamentals of Spectroscopy 2. Green Chemistry	4	3	3	25	75	100
EC - VIII (select any one)	24UECH63 24UECH64	1. Polymer Science 2. Agro Chemistry	4	3	3	25	75	100
SEC - VI	24USCH61 24USCH62	1. Applied Chemistry 2. Forensic Science	2	2	3	25	75	100
Study to / Field Visit Mandatory for the major courses								
		Total	**30**	**23**				

****SEC- Skill Enhancement Course** ****CIA- Continuous Internal Assessment**

****EC– Elective Course** ****ESE- End Semester Examination**

Semester - I

General Chemistry-I

Title of the Course		General Chemistry-I					
Course Type		Core - I					
Year	I	Semester	I	Credits	5	Course Code	24UMCH11
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		3	2		--	5	

Learning Objectives	
LO1	Various atomic models and atomic structure
LO2	Wave particle quality of matter
LO3	Periodic table, periodicity in properties and its application in explaining the chemical behaviour
LO4	Nature of chemical bonding
LO5	Fundamental concepts of organic chemistry

Unit	Contents
I	**Atomic structure and Periodic trends** History of atom (J.J. Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory-Bohr's model of atom;; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De-Broglie wavelength- Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli' exclusion principle and Aufbau principle; Numerical problem involving the core concepts.

II	**Introduction to Quantum mechanics** Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave functions, Formulation of Schrodinger wave equation – Probability and electron density-visualizing the orbitals - Probability density and significance of Ψ and Ψ^2. **Modern Periodic Table** **Cause of periodicity**; Features of the periodic table; - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity- electronegativity scales, applications of electro negativity. Problems involving the core concepts
III	**Structure and Bonding- Ionic bond** Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle–lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarization – polarising power and polarize ability; Fajans' rules - effects of polarization on properties of compounds; problems Involving the core concepts. **Covalent bond** Overlap of or bitals–σ and Π bonds; directed valency-hybridization;VSEPR theory-shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, $AB_6$and AB_7 Partial ionic character of covalent bond- dipole moment,application to molecules of the type A_2, AB, AB_2, AB_3, AB_4; percentage ionic character-numerical problems based on Calculation of percentage ionic character.
IV	**Structure and bonding–II** VB theory–application to hydrogen molecule; concept of resonance-resonance Structures of some inorganic species– CO_2, NO_2, CO^{2-},NO^- limitations of VBT; MO theory - bonding, ant bonding and nonbonding H_2, O2, $O2^+$, O_2^{2-}, O^{2-}, N2, NO, HF, CO; CO_2. Magnetic characteristics, comparison of VB and MO theories Coordinate bond: Definition, Formation of BF_3, NH_4^+, H_3O^+ , properties Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors, Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding–Types

V	**Basic concepts in Organic Chemistry and Electronic effects** Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents -electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes. Inductive effect – reactivity of alkyl halides, acidity of haloacids, basicity of amines; inductomeric and electromeric effects. Resonance – resonance energy, conditions for resonance – acidity of phenols, basicity of aromatic amines, carbonium ions, carbanions and free radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance. Hyper conjugation-stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitro methane Types of organic reactions- addition, substitution, elimination and rearrangements

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC and 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 Transferrable Skill

Recommended Texts:

1	Madan. R.D, and Sathya Prakash, *ModernInorganic Chemistry,* 2nd ed.; S.Chand and Company:NewDelhi, 2003.
2	Rao,C.N.R. University General Chemistry, Macmillan Publication: New Delhi, 2000.
3	Puri,B. R.and Sharma, L.R. *Principles of Physical Chemistry,* 38th ed.; Vishal Publishing Company: Jalandhar, 2002.
4	Bruce, P.Y. and Prasad K.J.R. *Essential Organic Chemistry*, Pearson Education: New Delhi, 2008.
5	Dash UN, Dharmarha OP, Soni P.L. Text book of Physical Chemistry,Sultan Chand & Sons: New Delhi,2016

References Books:	
1	Maron, S.H. and Prutton C.P. Principles of Physical Chemistry, 4 thed. The Macmillan Company: New york, 1972.
2	Lee,J.D. Concise Inorganic Chemistry, 4thed.ELBS William Heinemann: London, 1991.
3	Gurudeep Raj, Advanced Inorganic Chemistry,26 ed.; Goel Publishing House: Meerut, 2001.
4	Atkins, P.W. &Paula, J. Physical Chemistry, 10 th$^{ed.}$; Oxford University Press: New York, 2014.
5	Huheey, J.E. Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed.; Addison, Wesley Publishing Company: India, 1993.

Web Resources:	
1	https://onlinecourses.nptel.ac.in
2	http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm
3	http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorga nic.html
4	https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding https://www.chemtube3d.com/

Course outcomes CO	On completion of this course, students will be able to
CO1	Explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.
CO2	Classify the elements in the periodic table, types of bonds, Reaction intermediate electronic effects in organic compounds, types of reagents.
CO3	Apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx, Δp electronegativity, percentage ionic character and bond order
CO4	Evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects
CO5	Construct MO diagrams, predict trends in periodic properties, and assess the properties of elements, and explainhy bridization in molecules, nature of H – bonding and organic reaction mechanisms.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/ PSO	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

Quantitative Inorganic Estimation

Title of the Course	**Quantitative Inorganic Estimation**						
Course Type	**Core - Major Practicals - I**						
Year	**I**	**Semester**	**I**	**Credits**	**2**	**Course Code**	**24UMCHL1**
Instructional Hours Per week		**Lecture**		**Tutorial**	**Lab Practice**	**Total**	
		-		**--**	**3**	**3**	

Learning Objectives

LO1	Laboratory safety
LO2	Handling glass wares
LO3	Study the principle/equation of the experiment.
LO4	Quantitative estimation.

Experiments

Quantitative Estimation(Volumetric)

Preparation of standard solution, dilution from stock solution

Permanganometry

1. Estimation of sodium oxalate using standard ferrous ammonium sulphate.
2. Estimation of ferrous sulphate using standard oxalic acid.

Dichrometry

3. Estimation of ferric alum using standard dichromate (external indicator)
4. Estimation of ferric alum using standard dichromate (internal indicator)

Iodometry

5. Estimation of copper in copper sulphate using standard dichromate.

Complexometry

6. Estimation of hardness of water using EDTA.
7. Estimation of zinc using standard zinc sulphate solution.
8. Estimation of copper using standard zinc sulphate solution.
9. Estimation of nickel using standard zinc sulphate solution.

Estimations

10. Estimation of iron in iron tablets.
11. Estimation of ascorbic 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/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	Venkateswaran. V.; Veeraswamy. R.; Kulandivelu. A.R, *Basic Principles of Practical Chemistry,* 2nd ed.; Sultan Chand & Sons: New Delhi, 1997.
Reference Books	Nad, A.K.; Mahapatra, B.; Ghoshal, A.; *An advanced course in Practical Chemistry,* 3rd ed.; New Central Book Agency: Kolkata,2007.
Web sources	http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis https://chemdictionary.org/titration-indicator/

Course outcomes: CO	**On completion of this course, the students will be able to**
CO1	Explain the basic principles involved in titrimetric analysis.
CO2	Compare the methodologies of different titrimetric analysis
CO3	Calculate the concentrations of unknown solutions in different ways.
CO4	Develop the skill to estimate the amount of a substance present in a given solution.

Mapping with programme outcomes and programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	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

Food chemistry

Title of the Course	Food chemistry						
Course Type	Skill Enhancement Course - I						
Year	I	Semester	I	Credits	2	Course Code	24USCH11
Instructional Hours per week		Lecture		Tutorial	Lab Practice	Total	
		2		-	-	2	

Learning Objectives	
LO1	Types of food
LO2	Food adulteration and poisons
LO3	Food additives
LO4	Food preservation
LO5	Edible oils

Unit	Contents
I	**Food Adulteration** Sources of food, types, advantages and disadvantages. Food adulteration-contamination of Wheat, rice, milk, butter with clay stones, water and toxic chemicals- Common adulterants, Ghee adulterants and their detection. Detection of Adulterated foods by simple analytical techniques.
II	**Food Poison** Food poisons - natural poisons (alkaloids –nephron toxin) - pesticides, (DDT, BHC, and Malachi on) – Chemical poisons-First aid for poison consumed Victims.
III	**Food Additives** Food additives-artificial sweeteners–Saccharin- Cyclamate and Aspartate Food flavors-esters, aldehydes and heterocyclic compounds–Food colors–Emulsifying agents– preservatives-leavening agents. Baking powder–yeast–tastemakers–MSG-vinegar.
IV	**Beverages** Beverages-soft drinks-soda-fruit juices-alcoholic beverages-examples. Carbonation- addiction to alcohol–diseases of liver and social problems
V	**Edible Oils** Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats-iodine value-role of MUFA and PUFA in preventing heart diseases-determination of iodine value, RM value, saponification values and their significance.

Extended Professional Component (is a part of internal component only, Not to be included in the Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC and 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 Transferrable Skill
Recommended Texts	1. Food chemistry, H.K. Chopra, P.S. Panesar, Narosa publishing house, 2010. 2. Jayashree Ghosh, Concepts of Applied Chemistry, S.Chand & Co. Publishers, second edition, 2006. 3. Food Chemistry, Dr. L. Rakesh Sharma, Evince publishing, 2022. 4. Food processing and preservation, G.Subbulakshmi, Shobha A Udipi, Pdmini S Ghugre, Newage international publishers, second edition, 2021.
Reference books:	1. H.D. Belitz, Werner Grosch, Food Chemistry Springer Science 2. M. Swaminathan, Food Science and Experimental Foods, Gane shand Company, 1979. 3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008. 4. Food Chemistry, H. - D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009. 5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.
Web Resources	https://onlinecourses.nptel.ac.in http://cactus.dixie.edu/smblack/chem1010

Course outcomes: CO	On completion of this course, the students will be able to:
CO1	Explain the types of food adulterants.
CO2	Know about first aid and food poisons.
CO3	Know about first aid and food poisons.
CO4	Know the types of beverages.
CO5	Discuss the sources of edible oils

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	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

Foundation Course in Chemistry

Title of the Course	Foundation course in Chemistry						
Course Type	Foundation course						
Year	I	Semester	I	Credits	2	Course Code	24UFCH11
Instructional Hours Per week		Lecture	Tutorial		Lab Practice	Total	
		2	-		-	2	
Pre-requisite							
Learning Objectives							
LO1	Atomic structure and electronic configuration						
LO2	Types of chemical bonding						
LO3	Different states of mater and the general properties						
LO4	Nomen cloture of and isomerism in organic compounds						
LO5	Basic concepts of spectroscopy						

Unit	Contents
I	**Structure of atom and periodic classification of Elements and properties.** Fundamental particles-Atomic mass-Atomic number–Isotopes– Isobars– Isotones – Orbitals-Quantum number and their significance. Shapes of s, p and d orbitals-Periodic table-periodic laws (Mendeleev and Mosley) - Classification of elements into s, p, d and f-blocks. Metals- Nonmetals-Periodic properties-Concept, Variation and factors affecting various periodic properties-Inert pair effect.
II	**Chemical Bonding** Definition-Types of chemical bond-Ionic bond-Ion polarization-Dipole moment and Percentage of ionic character-Covalent bond-Definition–Concept of hybridization (sp, sp^2, sp3, sp^3d, sp^3d^2, dsp^2, d^2sp^3) – Magnetic properties – Paramagnetic– Diamagnetic-Ferromagnetic. Co-ordinate covalent bond-Definition– Examples-Co-ordination compounds (basic concepts only).
III	**Carbon compounds**- Uniqueness of carbons- Classification of hydrocarbons-IUPAC Nomenclature of Organic compounds **Isomerism:** Structural and Stereoisomerism Structural Isomerism: Chain isomerism, Functional isomerism, Positional isomerism and Meta isomerism. Stereoisomerism: Geometrical and Optical isomerism- Chiral molecule- Enantiomers- Disaster omers- Me so compounds-Racemic mixture.

IV	**Gaseous state**: Kinetic theory of gases- Ideal and Non- ideal gases- Ideal gas equation- Deviation of ideal gas from ideal behavior-Vander Waal's equation and Liquefaction of gases. **Liquids:** Vapour pressure and Boiling point of liquid- Surface tension –Viscosity-Factors affecting surface tension and viscosity. **Solids:** Definition- Characteristics of solids- Amorphous and Crystalline solids-Space Lattice and unit cells-Close packed structure of solids-Radius ratio rule.
V	**Introduction to Spectroscopy** Electromagnetic radiation-General characteristics of Wave–Wave length – Frequency– Amplitude – Wave number - Electromagnetic spectrum- Absorption and Emission spectrum-Quantization of Energy level - Selection rule-Intensity of the Spectral lines– Width of Spectral lines. Types of spectroscopy: Microwave spectroscopy, Infrared spectroscopy, UV-Visible spectroscopy, Nuclear Magnetic Resonance spectroscopy, Electron spin resonance spectroscopy.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts	1. B.R. Puri, L.R. Sharma, K.C. Kalia, Principles of Inorganic chemistry, Milestone Publishers an d Distributors, New Delhi,2012. 2. B.R. Puri and L.R. Sharma, 38th edition, Vishal Publishing Company, Jalendar2002. 3. K.S. Tewari, S.N. Mehrothra and N.K.Vishnoi, Text book of Organic Chemistry, 2nd edition Vikas publishing House, New Delhi, 1998.
Reference books	1. R.D.Madan, Sathya Prakash, Mordern Inorganic chemistry 2nd edition, 2. S.Chand and company, New Delhi, 2003. 3. B.S.Bhal, Arun Bhal, Advanced Organic chemistry, 3rd edition, 4. S.Chandand Company, New Delhi, 2003. 5. U.N. Dash, O.P. Dharmarha, P.L. Soni, Text book of Physical Chemistry, Sultan Chand & sons, New Delhi, 2016. 6. Y.R. Sharma Organic spectroscopy Principles and Chemical applications, S.Chand & Company PVT Ltd, 2002. 7. C.N. Banwell, Fundamentals of spectra's copy Tata McGraw Hill, 1983.
Web Resources	https://onlinecourses.nptel.ac.in http://cactus.dixie.edu/smblack/chem1010/lec

Course outcomes CO	On completion of this course, the students will be able to
CO1	Learn about atomic structure and periodic properties.
CO2	Gain knowledge on types of chemical bonding
CO3	Explain different states of matter
CO4	Discussion on nomenclature and isomerism in organic compounds
CO5	Knowledge on electromagnetic radiation and its integration with matter

Mapping with programme outcomes and programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	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

Semester - II

General Chemistry – II

Title of the Course	General Chemistry - II						
Course Type	Core - II						
Year	I	Semester	II	Credits	5	Course Code	24UMCH21
Instructional Hours per week		Lecture		Tutorial	Lab Practice	Total	
		3		2	-	5	
Learning Objectives: This course aims at providing an overall view of							
LO 1	The Chemistry of acids, bases and ionic equilibrium.						
LO 2	Properties of s and p – block elements						
LO 3	Chemistry of hydrocarbons						
LO 4	Applications of acids and bases						
LO 5	Compounds of main block elements and hydrocarbons						

Unit	Contents
I	Acids, bases and Ionic equilibrium Concepts of Acids and Bases - Arrhenius concept Bronsted Lowry concept, Lewis concept; Relative strengths of acids, bases and constant; ionic product of water, pH scale, pH of solutions; Degree of dissociation, common effect, factors affecting degree of dissociation; acid base indicators, theory of acid base Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson- Hassel balch equation; Salt hydrolysis - salts of weak acids and strong bases, weak bases and acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation hydrolysis constant and degree of hydrolysis; Solubility product determination and applications;
II	Chemistry of s-Block Elements Hydrogen: Position of hydrogen in the periodictable Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Alkaline earth metals. Anomalous behaviour of Be. Chemistry of p-Block Elements (Group13 &14) Preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. Comparison of carbon with silicon. Carbon-di-sulphide

III	**Chemistry of p-Block Elements (Group 15-18)** General characteristics of elements of Group 15; Chemistry of H_2N-NH_2, NH_2OH, NH_3 Chemistry of PH_3, PCl_3, PCl_5 and oxyacids of phosphorous (H_3PO_3 and H_3PO_4) General properties of elements of group16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids). **Chemistry of Halogens**: General characteristics of halogen with reference to electro- negativity, electron affinity, oxidation states and oxidizing power. Inter-halogen compounds (ICl, ClF_3,BrF_5 and IF_7), pseudo halogens [$(CN)_2$ and $(SCN)_2$]
IV	**Hydrocarbon Chemistry-I** **Petro products:** Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and use **Alkenes**-Nomenclature, general methods of preparation– Mechanism of elimination reactions–E_1 and E_2 mechanism- factors influencing–stereochemistry–orientation Hofmann and Saytzeff rules. Reactions of alkenes–addition reactions– mechanisms Markownikoff's rule, oxidation reactions– hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization. **Alkadienes** Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels– Alder reactions. **Alkynes** Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, **Cycloalkanes:** Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations.
V	**Hydrocarbon Chemistry-II** **Benzene:** Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) electron rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenations. Friedel-Craft's alkylation and acylation. **Polynuclear Aromatic hydrocarbons**: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at alpha position – reduction – oxidation – uses.

Extended professional component (is a part of internal component only, not to be included in the External Examination question paper)	(To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts:	
1	Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed, S.Chand and Company, New Delhi.
2	Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S. Chand and Company, New Delhi.
3	Bahl BS, ArunBhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi.
4	Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed.,Vishal Publishing Company, Jalandhar.
5	TewariKS, MehrothraS N and Vishnoi NK,(1998),Textbook of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi.
References Books:	
1	MaronS H and PruttonCP,(1972), Principles of Physical Chemistry,4th ed.,The Macmillan Company, Newyork.
2	Barrow GM,(1992),Physical Chemistry,5th ed.,Tata McGraw Hill, New Delhi.
3	Lee JD, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London
4	Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India.
5	Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol–I, 26th. Goel Publishing House, Meerut.
6	Agarwal OP, (1995), Reactions and Reagents in Organic Chemistry, 8 ed., Goel Publishing House, Meerut.

Web Resources:

https://onlinecourses.nptel.ac.in
http://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.htm
http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding **MOOC components**
http://nptel.ac.in/courses/104101090/
Lecture1: Classification of elements and periodic properties
http://nptel.ac.in/courses/104101090/

Course outcomes CO	On completion of this course, students will be able to:
CO1	Explain the concept of acids, bases and ionic equilibrium; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons
CO2	Discuss the periodic properties of s and p-block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids
CO3	Classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p- block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons
CO4	Explain theories of acids, bases and indicators, buffer action and important compounds of s - block elements
CO5	Assess the application of hard and soft acids indicators, buffers, compounds of s and p- block elements and hydrocarbons.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	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

Preparation of Organic and Inorganic Compounds and Determination of Physical constants

Title of the Course	**Preparation of Organic and Inorganic Compounds and determination of Physical constants**						
Course Type	**Core – II - Lab**						
Year	**I**	**Semester**	**II**	**Credits**	**2**	**Course Code**	**24UMCHL2**
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**		**Total**
		-	**-**		**3**		**3**
Learning Objectives : This course aims at providing knowledge on							
LO1	Preparation of organic compounds						
LO2	Preparation of Inorganic compounds						
LO3	Crystallization of crude sample.						
LO4	Study the principle/equation of the experiment.						
LO5	Determination of boiling and melting point of organic compounds						

Experiments

Unit I

Preparation of Organic Compounds

1. Nitration-picric acid from Phenol
2. Halogenation-p-bromo acetanilide from acetanilide
3. Oxidation-benzoic acid from Benzaldehyde
4. Benzoic acid from Benzamide
5. Ethyl benzoate to Benzoic acid
6. Salicylic acid from Methyl Salicylate
7. Rearrangement-Benzil to Benzilic acid
8. Methyl orange from sulphanilic acid

Unit II

Preparation of Inorganic compounds-

1. Potash alum
2. Tetraammine copper (II) sulphate
3. Hexammine cobalt (III) chloride
4. Mohr's salt
5. Hexathiourea lead (II) nitrate
6. Sodium ferri oxalate
7. Tristhiourea copper (I) chloride

Purification of organic/inorganic compounds by crystallization (from water/alcohol and distillation.

Unit III Determination of boiling point and melting point of organic substance/ solvents. **Experiments for demonstration** 1. **Steam distillation**-Extraction of essential oil from citrus fruits/eucalyptus leaves. 2. **Chromatography(anyone)(Group experiment)** a. Separation of amino acids by Paper Chromatography b. Thin Layer Chromatography-mixture of sugars/plant pigments /permanganate, dichromate. c. Column Chromatography-extraction of carotene, chlorophyll land xanthophylls from leaves/separation of anthracene-anthracene picrate. 3. **Electrophoresis–**Separation of amino acids and proteins. Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar.(Any one Group experiment)	
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Reference Books:	1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012. 2. Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018. 3. Gurtu, J.N; Kapoor, R. Advanced Experimental Chemistry (Organic), Sultan Chand: New Delhi, 1987. Furniss,B.S.; Hannaford, A.J.; Smith,P.W.G.; Tatchell, A.R. Vogel's Textbook of Practical organic Chemistry, 5th ed.; Pearson: India, 1989.
Web resources:	https://www.vlab.co.in/broad-area-chemical-sciences
Course outcomes: CO	**On completion of this course, the students will be able to**
CO1	Explain the method of preparation of organic compounds
CO2	Discuss the preparation of inorganic compounds.
CO3	Find out the physical constants of organic compounds.
CO4	Explain the purification of crude sample

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	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

Dairy Chemistry

Title of the Course	Dairy Chemistry						
Course Type	Skill Enhancement Course - II						
Year	I	Semester	II	Credits	2	Course Code	24USCH21
Instructional Hours Per week		Lecture	Tutorial		Lab Practice	Total	
		2	-		-	2	

Learning Objectives : This course aims at providing an overall view of the

LO1	Composition of Milk
LO2	Processing of milk
LO3	Preservation and formation of milk products.
LO4	Chemistry of milk and milk products
LO5	Processing of Fermented and other Milk Products

Unit	Contents
I	**Composition of Milk** Milk-definition-general composition of milk- constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals – physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity - Factors affecting the composition of milk - adulterants, preservatives with neutralizer- examples and their detection- estimation of fat, acidity and total solids in milk.
II	**Processing of Milk** Microbiology of milk-destruction of micro-organisms in milk, physico–chemical changes taking place in milk due to processing - boiling, pasteurization – types of pasteurization - Bottle, Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.
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.

IV	**Special Milk** Standardised milk - definition - merits - reconstituted milk - definition – flow diagram of manufacture - Homogenised milk - flavoured milk – vitaminised milk - toned milk – Incitation milk-Vegetable toned milk-humanized milk- condensed milk-definition, Composition and nutritive value.
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- acidophilous milk–Yoheer Indigeneous products-khoa and chhena definition- Ice cream - definition-percentage composition-types-ingredients-manufacture of ice– cream, stabilizers –emulsifiers and their role- milk powder-definition-Need for making milk powder-drying process- types of drying.

Extended Professional Component (is a part of internal component only ,Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts	1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, firstedition, 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. Datta Roy, P. Dinaka. , Indian Council of Agricultural Research, 1 st edition, 2008. 4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st 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, New York, 2005. 2. F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006. 3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980. 4. P.F.Fox and P.L.H.Mcsweeney, 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.O Mahony, Springer, Second edition,2015.

Web Resources	e-pathshala https://www.agrilcareer.com-pdf

Course Outcomes

Course outcomes CO	On completion of this course, the students will 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

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	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

Role of Chemistry in Daily Life

Title of the Course	Role Of Chemistry In Daily Life						
Course Type	Skill Enhancement Course -III						
Year	I	Semester	II	Credits	2	Course Code	24USCH22
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		2	-		-	2	

Learning Objectives : This course aims at providing an overall view of the

LO1	Importance of Chemistry in everyday life
LO2	Chemistry of building materials
LO3	Chemistry of Drugs and pharmaceuticals
LO4	Chemistry of food and Nutrition
LO5	Importance of fertilizers

Unit	Contents
I	**General survey of chemicals used in everyday life**. Air - components and their importance; photosynthetic reaction, air pollution, green-house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution.
II	**Building materials**-Cement, ceramics, glass and refractories-definition, composition and application only. Plastics-polythene, PVC, bakelite, polyesters, melamine- formaldehyde resins-preparation and uses only.
III	**Food and Nutrition** - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins (sources and their physiological importance).Cosmetics–tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes- general formulation and preparations – possible hazards of cosmetic use.
IV	**Chemicals in food production**–fertilizers-need, natural sources; urea, NPK fertilizers and superphosphate. Fuel– classification-solid, liquid and gaseous; nuclear fuel examples and uses.
V	**Pharmaceutical drugs** - Analgesics and antipyretics - paracetamol and aspirin. Colour chemicals-pigments and dyes-examples and applications. Explosives- classification and examples.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC /TRB/NET/UGC – CSIR/GATE /TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts	• Food chemistry, H.K. Chopra, P.S. Panesar, Narosa publishing house, 2010. • A textbook of pharmaceutical chemistry by Jaya shree Ghosh, S Chand publishing, 2012. • S. Vaithyanathan, Textbook of Ancillary Chemistry; Priya Publications, Karur, 2006. • B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. • Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019. • Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006.
Reference Books	• Randolph.Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourth edition, 1977. • W.A.Poucher, Joseph.A.Brink ,Jr .Perfumes, Cosmetics and soaps, Springer, 2000.A.K.De, Environmental Chemistry, New Age International Public Co., 1990

Course Outcomes

Course outcomes: CO	On completion of the course the students should be able to
CO1	Learn about the chemicals used in everyday life as well as air pollution and water pollution
CO2	Get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC, bake lite, polyesters,
CO3	Acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats, also have an awareness about Cosmetics Toothpastes, face powder, soaps and detergents.
CO4	Discuss about the fertilizers like urea, NPK fertilizers and superphosphate Fuel classifications, liquid and gaseous; nuclear fuel- examples and uses.
CO5	Have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about Pigments and dyes and its applications.

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	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

Semester - III

General Chemistry - III

Title of the Course		**General Chemistry - III**				
Course Type		**Core - III**				
Course Code		**24UMCH31**				
Year	**II**	**Semester**	**III**	**Credits**	**5**	
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**
		5			**--**	**5**

Learning Objectives ; This course aims at providing an overall view of

LO1	The physical properties of gases, liquids, solids and X-ray diffraction of solids.
LO2	Fundamentals of nuclear chemistry and nuclear waste management.
LO3	Applications of nuclear energy
LO4	Basic chemistry of halo-organic compounds, phenol and other aromatic alcohols.
LO5	Preparation and properties of phenols and alcohols.

Unit	Contents
I	**Gaseous state** Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; The Maxwell–Boltzmann distribution of speed of molecules-average, root mean square and most probable velocity and average kinetic energy,law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases. **Real gases**: Deviations from ideal gas behavior, compressibility factor, Z, and its variation with pressure for different gases. Equations of states for real gases–VanderWaal's equation; Boyle temperature, isotherms of realgases–critical phenomena– isotherms of CO_2 -continuity of state –Vanderwaal's equation and the critical state; law of corresponding states-liquefaction of gases
II	**Solid State** Crystals–size and shape; laws of crystallography; symmetry elements–plane, Centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg's equation. Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO2; comparison of structure and properties of diamond and graphite; Defects in solids-stoichiometric and non- stoichiometric defects. **Liquid crystals**–Classification and applications
III	**Nuclear Chemistry** Natural radioactivity -α, β and y rays; half-life period; Fajan– Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, nuclear isomerism; radioactive decayseries; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series. Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. Nuclear energy; nuclear fission and fusion– major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.

IV	**Halogen derivatives** **Aliphatic halogen derivatives** Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions –S_{N1} and S_{N2} mechanisms with stereochemical aspects and effect of solvent. **Aromatic halogen compounds** Nomenclature, preparation, properties and uses Mechanism of nucleophilic aromatic substitution–benzyne intermediate **Alcohols:** Nomenclature, classification, preparation, properties, use; conversions– ascent and descent of series; test for hydroxyl groups. Oxidation of diols by per iodic acid and lead tetra acetate. Test for alcohols
V	**Phenols** Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raschig process; properties – acidic character and effect of substitution on acidity. Reactions–Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction. Resorcinol, quinol, picricacid–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, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts:	
1	B.R. Puri, L.R. Sharma, M.S.Pathania; *Principles of Physical Chemistry*, 46th edition, Vishal Publishing, 2020.
2	B.R. Puri, L.R. Sharma and K.C.Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.
3	P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & amp; Sons, twentieth edition, 2006.
4	M.K.Jain, S.C.Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.
5	S.M.Mukherji, and S.P.Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
References Books:	
1	T.W. Graham Solomons, *Organic Chemistry*, John Wile y& amp; Sons, fifth edition, 1992.
2	A. Carey Francis, *Organic Chemistry*, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, 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.
Web Resources:	
1	**MOOC components** https://nptel.ac.in/courses/104104101Solidstate chemistry https://nptel.ac.in/courses/103106071Nuclear industries and safety https://nptel.ac.in/courses/104106119s Introduction to organic chemistry

Course outcomes CO	On completion of this course, students will be able to:
CO1	Explain the kinetic properties of gases by using mathematical concepts.
CO2	Describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations
CO3	Investigate the radioactivity, nuclear energy and its production, also the nuclear waste management.
CO4	Write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols
CO5	Investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	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

Qualitative Inorganic Analysis (Mixture)

Title of the Course	**Qualitative Inorganic Analysis (Mixture)**					
Course Type	**Core - III Lab**					
Course Code	**24UMCHL3**					
Year	**II**	**Semester**	**III**	**Credits**	**2**	
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**
		-	**-**		**3**	**3**

Learning Objectives : This course aims at providing knowledge on

LO1	To develop the skill on systematic analysis of mixture of inorganic salts.
LO2	Study the principles/equation of the experiment.
LO3	Study the ionic reactions

Experiments

Semi-Micro Qualitative Analysis

1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, 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, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium.
5. Analysis of a mixture containing two cations and two anions – of which one is interfering type.

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Reference Books:	Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012.
Web resources:	https://www.vlab.co.in/broad-area-chemical-sciences

	On completion of this course, students will be able to:
CO1	Acquire knowledge on the systematic analysis of simple salts.
CO2	Understand the nature of ionic reactions
CO3	Identify the captions and anions in the unknown inorganic mixture.
CO4	Identify the captions and anions in water and to test the quality of water.
CO5	Identify the captions and anions in the soil and to test the quality of soil. Assess the role of common ion effect and solubility product.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	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

Entrepreneurial Skills in Chemistry

Title of the Course	**Entrepreneurial Skills in Chemistry**				
Course Type	**Skill Enhancement Course – IV Lab**				
Course Code	**24USCHL1**				
Year	**II**	**Semester**	**III**	**Credits**	**2**
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**
		-	**-**		**2**

Learning Objectives : This course aims at providing training to	
LO1	Develop entrepreneurial skills in students
LO2	Provide hands on experience to prepare and develop products
LO3	Study the principle/equation of the experiment
LO4	Develop start ups
LO5	Know about food adultrants

Unit	Content
I	**Food Chemistry** Food adulteration–contamination of food items with clay stones, water and toxic chemicals -Common adulterants. Food additives, Natural and synthetic, antioxidants, glazing agents (hazardous effect), food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast, MSG, vinegar. **Dyes** Classification–Natural, synthetic dyes and their characteristics–basic methods and principles of dyeing.
II	Hands on Experiments (Students can choose any four) Detection of adulterants in food items like coffee, tea, pepper, chillipowder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques. Preparation of Jam, squash and Jelly, Gulkand, cottage cheese. Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale. Extraction of oils from spices and flowers. Testing of water samples using testing kit. Dyeing–cotton fabrics with natural and synthetic dyes Printing–tie and dye, batik.

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Reference Books:	George S & Muralidharan V, (2007) Fibre to Finished Fabric–A Simple Approach, Publication Division, University of Madras, Chennai. Appaswamy GP, A Hand book on Printing and Dyeing of Textiles ShyamJha, Rapid detection of food adulterants and contaminants (Theory and Practice), Elsevier,eBook ISBN 9087128004289,1st Edition,2015
Web resources:	https://www.vlab.co.in/broad-area-chemical-sciences
Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Identify adulterated food items by doing simple chemical tests.
CO2	Prepare cleaning products and become entrepreneurs
CO3	Educate others about adulteration and motivate them to become entrepreneurs.
CO4	Dye fabric with natural/ synthetic dye
CO5	Extract oils from spices /flowers.

Mapping With Programme Outcomes and Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	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

Allied Chemistry

Generic Elective-I Chemistry

(For Physics, Botany and Zoology students)

Title of the Course		Generic Elective-I Chemistry					
Course Type		Generic Elective-I					
Year	II	Semester	III	Credits	3	Course Code	24UECH31
Instructional Hours Per week		Lecture	Tutorial		Lab Practice	Total	
		4	-		--	4	
Learning Objectives: This course aims at providing knowledge on							
LO1	Concepts of nuclear chemistry						
LO2	Importance of chemical industries						
LO3	Fundamental concepts in organic chemistry						
LO4	Qualitative and an alytical methods.						
LO5	Chemicals in Pharmaceutical chemistry						

UNIT	CONTENTS
I	**Nuclear Chemistry**: Fundamental particles- Isotopes, Isobars, Isotones and Isomers- Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy definition- mass defect calculations. Nuclear fission and nuclear fusion- Stellar energy. Applications of radioisotopes- carbon dating and applications.
II	**Industrial Chemistry** ***Fuels***: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). ***Fertilizers***: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate. ***Pesticides*** Definition - Classification of Pesticides based on the use and chemicalcomposition - examples - general methods of application - Benefits of pesticides - Potential hazards. Safety measures-first aid Biopesticides**:** Pheromones, attractants, repellents
III	**Fundamental Concepts in Organic Chemistry** Hybridization: Hybridization and geometry of CH_4, C_2H_4, C_2H_2. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric effect definition with examples only.

IV	**Analytical Chemistry** Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation andpurification techniques: Extraction, distillation and crystallization.Chromatography: Principle and application of column, paper and thin layer chromatography.
V	**Drugs and Speciality Chemicals** Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether: Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon

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 Transferrable Skill
Recommended Texts:	
1	V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2	S.Vaithyanathan, Text book of Ancillary Chemistry, Priya Publications, Karur, 2006.
3	Arun Bahl, B.S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012.
4	P.L. Soni, H.M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Web Resources:	
http://fazaia.edu.pk-Library	

Course outcomes CO	On completion of this course, students will be able to:
CO1	Gain in-depth knowledge about nuclear reactions and its applications.
CO2	Evaluate the efficiencies and uses of various fuels and fertilizers
CO3	Explain the type of hybridization, electronic effect and mechanism
CO4	Explain various methods to identify an appropriate method for the separation of chemical components.
CO5	Understand the uses of chemicals in medicine

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	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

Allied Chemistry Practical - I

Inorganic Volumetric Analysis
(For Physics, Botany and Zoology Students)

Title of the Course	**Inorganic Volumetric Analysis**						
Course Type	**Elective - Lab - I**						
Year	**II**	**Semester**	**III**	**Credits**	**2**	**Course Code**	**24UECHL1**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**		**Total**
		-	**-**		**2**		**2**
Learning Objectives: This course aims at providing knowledge on							
LO1	Basics of preparation of solutions						
LO2	Basic principles and practical experience of volumetric analysis						

EXPERIMENTS	
VOLUMETRICANALYSIS 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 mohrssalt. 4. Estimation of oxalic acid using standard ferrous sulphate.. 5. Estimation of ferrous ion using diphenylamine as indicator. 6. Estimation of zinc using EDTA. 7. Estimation of magnesium using EDTA.	
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Reference Books:	Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. *Basic Principles of Practical Chemistry*, 2nd ed.; Sultan Chand: New Delhi, 2012.

Course outcomes CO	On completion of this course, students will be able to:
CO1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO2	Design, carryout, record and inter pretthe results of volumetric titration.
CO3	Apply their skill in the analysis of water/hardness.
CO4	Analyze the chemical constituents in allied chemical products

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	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

Semester - IV
General Chemistry - IV

Title of the Course		**General Chemistry - IV**					
Course Type		**Core - IV**					
Year	**II**	**Semester**	**IV**	**Credits**	**5**	**Course Code**	**24UMCH41**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**		**Total**
		5			**--**		**5**

Learning Objectives ; This course aims at providing an overall view of	
LO1	Adsorption, homogeneous and heterogeneous catalysis.
LO2	Colloids and macromolecules.
LO3	Transition elements with reference to periodic properties and group study of transition metals.
LO4	Inner Transition elements with reference to periodic properties and group study of inner transition metals.
LO5	Preparation and properties of saccharides

Unit	Contents
I	**Surface Chemistry** **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 catalyzed reaction – Michaelis - Menten and Briggs - Haldane equation – Line weaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations). **Catalysis** – General characteristics of catalytic reactions, autocatalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid–base and enzyme catalysis. Heterogeneous catalysis.
II	**Colloids and Macromolecules** **Colloids:** Types of Colloids, Characteristics of Colloids (Lyophilic and Lyophobic sols), Preparation of Sols - Dispersion methods, aggregation methods, Properties of Sols - Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis, Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels - preparation of Gels, Applications of colloids, **Macromolecules**: Molecular weight of Macromolecules - Number average molecular weight – average molecular weight, Determination of Molecular weight of molecules

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, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups
IV	**Inner transition elements (Lanthanides and Actinides)** General characteristics of f-block elements - Comparative account of lanthanides and actinides - Occurrence, Oxidation states, Magnetic properties, Colour and spectra – lanthanides and actinides Separation by ion-Exchange and Solvent extraction methods - Lanthanides contraction- Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.
V	**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–aldo hexoses 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 homo polysaccharides – starch and cellulose,

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 Transferrable Skill

Recommended Texts:	
1	B.R. Puri, L.R. Sharma, M.S. Pathania; Principles of Physical Chemistry, 46th edition, Vishal Publishing, 2020.
2	B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.
3	P.L.Soni and Mohan Katyal, Textbook of Inorganic Chemistry, Sultan Chand & amp; Sons, twentieth edition, 2006.
4	M.K.Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2003.
5	S.M.Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 1994.

References Books:	
1	T.W. Graham Solomons, Organic Chemistry, John Wile y& amp; Sons, fifth edition, 1992.
2	Carey Francis,Organic Chemistry, Tata McGraw-Hill Education Pvt., Ltd.,New Delhi, seventh edition, 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.
Web Resources:	
1	1. https://nptel.ac.in 2. https://swayam.gov.inwww.epgpathshala.nic.in

Course outcomes CO	On completion of this course, students will be able to:
CO1	Compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.
CO2	Demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules
CO3	Investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions
CO4	Investigate the chemistry of inner transition elements with respect to various periodic properties and group wise discussions
CO5	Explain preparation and reactions of mono and disaccharides

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	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

Qualitative Organic Analysis

Title of the Course	**Qualitative Organic Analysis**						
Course Type	**Core - IV - Lab**						
Year	**II**	**Semester**	**IV**	**Credits**	**2**	**Course Code**	**24UMCHL4**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**		**Total**
		-	**-**		**3**		**3**
Learning Objectives : This course aims at providing knowledge on							
LO1	Laboratory safety						
LO 2	Handling glass wares						
LO 3	Analysis of organic compounds						
LO 4	Preparation of derivatives						

Experiments

Unit-I

Safety rules, symbols and first-aid in chemistry laboratory

Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware – basic information and uses.

Unit- II

Qualitative Organic Analysis

Preliminary examination, detection of special elements -nitrogen, sulphur and halogens. Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests

Confirmation of functional groups

Mono carboxylic acid, dicarboxylic acid

Monohydric phenol, polyhydric phenol

aldehyde, ketone, ester

carbohydrate (reducing and non-reducing sugars)

Amines

mono amide, diamide,

Anilide, nitro compound

Preparation of derivatives

for functional groups.

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Reference Books:	1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012. 2. Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018. 3. Gurtu, J.N; Kapoor, R. Advanced Experimental Chemistry (Organic), Sultan Chand: New Delhi, 1987. 4. Furniss,B.S.;Hannaford,A.J.;Smith,P.W.G.;Tatchell, A.R. Vogel's Textbook Of Practical organic Chemistry, 5th ed.; Pearson: India, 1989.
Web resources:	https://www.vlab.co.in/broad-area-chemical-sciences

Course outcomes CO	**On completion of this course, students will be able to:**
CO1	Observe the physical state, odour, colour and solubility of the given organic compound.
CO2	Identify the presence of special elements
CO3	Identify functional group in an unknown organic compound performing a systematic analysis
CO4	Compare mono and dicarboxylic acids, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugar and explain the reactions behind it.
CO5	Exhibit a solid derivative with respect to the identified functional group.

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	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

Instrumental Methods of Chemical Analysis

Title of the Course		Instrumental Methods Of Chemical Analysis					
Course Type		Skill Enhancement Course - V					
Year	II	Semester	IV	Credits	2	Course Code	24USCH41
Instructional Hours Per week		Lecture	Tutorial		Lab Practice		Total
		2	-		--		2

Learning Objectives; This course aims at providing an overall view of	
LO1	Operation and troubleshooting of chemical instruments
LO2	Fundamentals of analytical techniques and its application in the characterization of compounds
LO3	Theory of Chroma to graphics separation
LO4	Theory of thermo/electro analytical techniques
LO5	Stoichiometry and the related concentration terms

UNIT	CONTENTS
I	**Qualitative and Quantitative Aspects of Analysis** S.I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q- test, F-test, T-test. The Least Square Method for Deriving Calibration plots.
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.

III	**UV-Visible and IRS pectros copy** Origin of spectra, interaction of radiation with matter, fundamental laws of spectros copy and selection rules, validity of Beer-Lambert's law. ***UV – Visible Spectrometry*:** Basic principles, instrumentation – choice of source, mono chromator and detector for single and double be am instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, And keto-enol tautomer's. ***Infrared Spectros copy*:** Basic principles of instrumentation -Choice of source, monochromator & detector for single and double beam instrument; sampling techniques.
IV	**Thermal and Electro-analytical Methods of Analysis** ***Thermal Methods*** 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.
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 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 Transferrable Skill

Recommended Texts:	
1	Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.
2	R.Gopalan, P.S.Subramanian and K.Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007
3	Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017).
4	R.Speyer, Thermal Analysis of Materials, CRC Press, 1993.
5	R.A.Dayand A.L.Underwood, Quantitative Analysis, 6th edn., Prentice Hall ofIndia Private Ltd., New Delhi, 1993
References Books:	
1	D.A.Skoog, D.M.West and F.J.Holler, Analytical Chemistry: An Introduction, 5th edn. Saunders college publishing, Philadelphia, 1998.
2	Dash U.N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011
3	Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004.
4	Mikes, O.& Chalmes, R.A. Laboratory Hand book of Chromatographic & Allied Methods, Elles Harwood Ltd. London
5	G.H.Jeffery, J.Bassett, J.Mendham and R.C.Denney, Vogel's Text book of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000
Web Resources:	
1	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 outcomes CO	On completion of this course, students will be able to:
CO1	Apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry
CO2	Explain theory, instrumentation and application of UV visible and Infrared spectroscopy.
CO3	Able to discuss instrumentation, theory and applications of thermal and electro chemical techniques
CO4	Use chroma to graphic techniques in the separation and identification of mixtures
CO5	Explain preparation of solutions, stoichiometric calculations.

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	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

Allied Chemistry

Generic Elective - II
Chemistry (For Physics, Botany and Zoology Students)

Title of the Course		Generic Elective-II Chemistry (For Physics, Botany and Zoology Students)					
Course Type		Generic Elective-II					
Year	II	Semester	IV	Credits	3	Course Code	24UECH41
Instructional Hours Per week		Lecture	Tutorial		Lab Practice	Total	
		4			--	4	
Learning Objectives: This course aims at providing knowledge on							
LO1	The Co-ordination Chemistry and Water Technology						
LO2	Carbohydrates and Amino acids						
LO3	Basics and applications of catalysis						
LO4	Food additives and preservatives						
LO5	Photochemistry						

UNIT	CONTENTS
I	**Co-ordination Chemistry and Water Technology** Co-ordination Chemistry: Definition of terms- Pauling's theory- Postulates Applications to [Ni (CO) 4], [Ni (CN) 4]$^{2-}$, [Co (CN) 6]$^{3-}$ Chelation Biological role of Haemoglob in and Chlorophyll (elementary idea) Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of Hardness of water using EDTA method, zeolite method- Purification techniques- BOD, COD.
II	**Carbohydrates and Amino acids** Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose- fructose interconversion. Properties of starch and cellulose. Amino acids: Classification preparation and properties of alanine, preparation of dipeptides using Bergmann method.
III	**Catalysis** – General characteristics of catalytic reactions, autocatalysis, promoters, negative catalysis, poisoning of a catalyst –theories of homogenous and heterogeneous catalysis – Kinetics of Acid–based and enzyme catalysis. Heterogenous catalysis
IV	**Food additives and preservatives** Food Additives : Definition – Functions of Food Additives – Advantages of Food Additives – Types of Additives – Antioxidants, Acid modifiers, Foaming agents, Sweeteners, Emulsifiers, Thickners, Nutritive agents, Flavours and Flavours, enhancers, Humectants, Food Colourants. Food Preservatives : Definition – Principles of Food Preservations – Role of Food Preservations- Methods of Food Preservations – Physical, Chemical and Biological methods .Food standards – Agmark and Codex alimentarius.
V	**Photochemistry** Beer –Lamberts law, Grothus Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield Hydrogen - chloride reaction. Phosphorescence, fluorescence, chemiluminescence photosensitization and photosynthesis (definition with examples)

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 Transferrable Skill

Recommended Texts:	
1.	V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2.	S.Vaithyanathan, Text book of Ancillary Chemistry, Priya Publications, Karur, 2006.
3.	ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
4.	P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference book	
1.	P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2.	R.Puri, L.R. Sharma, M.S.Pathania, and Text book Physical Chemistry: Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
3.	B.K,Sharma,IndustrialChemistry;GOELpublishinghouse,Meerut,sixteenth edition, 2014

Course outcomes CO	On completion of this course, students will be able to:
CO1	Apply Pauling's theory to explain the bonding in coordination compounds.
CO2	Explain the preparation and property of carbohydrate
CO3	Enlighten the role of catalysts in organic reactions
CO4	Identify the chemicals used as food additives or preservatives
CO5	Outline the various type of photochemical process.

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	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

Allied Chemistry Practical – IV

Qualitative Inorganic Analysis
(For Physics, Botany and Zoology students)

Title of the Course	**Qualitative Inorganic Analysis**						
Course Type	**Elective – Lab - II**						
Year	**II**	**Semester**	**IV**	**Credits**	**2**	**Course Code**	**24UECHL2**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**		**Total**
		-	**-**		**2**		**2**
Learning Objectives: This course aims at providing knowledge on analysis of inorganic salts.							

EXPERIMENTS

Semi-Micro Qualitative Analysis

1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, 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, cadmium, nickel, cobalt, barium, ammonium.
5. Analysis of a simple salt containing operation and one anion.

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Reference Books:	Venkateswaran, V.;Veeraswamy, R.; Kulandaivelu, A.R. *Basic Principles of Practical Chemistry*, 2nd ed.; Sultan Chand: New Delhi, 2012.
Web Resource	https://www.vlab.co.in/broad-area-chemical-sciences

Course outcomes CO	**On completion of this course, students will be able to:**
CO1	Acquire knowledge on the systematic analysis of simple salts.
CO2	Identify the cations and an ions in the unknown substance.
CO3	Identify the cations and an ions in the soil and water and to test the quality of water
CO4	Assess the role of communion effect and solubility product

Mapping With Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	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

Semester - V
Organic Chemistry –I

Title of the Course		**Organic Chemistry - I**					
Course Type		**CORE - V**					
Year	**III**	**Semester**	**V**	**Credits**	**5**	**Course Code**	**24UMCH51**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	**1**		**--**	**5**	

Learning Objectives ; This course aims to provide an understanding of	
LO1	The organic chemistry of carbonyl compounds and carboxylic acids.
LO2	Preparation and properties of aromatic and aliphatic nitro compounds and Amines.
LO3	Preparation of different dyes, food colour and additives.
LO4	Preparation and properties of five membered heterocycles like pyrrole, furan and thiophene.
LO5	Preparation and properties of six membered heterocycles like pyridine, quinolone and isoquinoline.

UNIT	CONTENTS
I	**Aldehydes and Ketones** Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reaction, base catalyze 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, Wolf - Kishner reduction, Meerwein – Pondorf Verley reduction, reduction with $LiAlH_4$ and $NaBH_4$. **Carboxylic Acids**: Nomenclature, structure, preparation and reactions of aliphatic and aromatic mono carboxylic acids. Physical properties, Acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, Decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxyl acids and unsaturated acids.

II	**Chemistry of Nitrogen Compounds–I** **Nitro alkanes** Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions–reduction, halogenations, Pseudo acid character. Nitro-acinitro tautomerism. **Aromatic nitro compounds** Nomenclature, preparation–nitration, from diazonium salts, physical properties; reactions –reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT. **Amines: Aliphatic amines** Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis. Physical properties, reactions–alkylation, acylation, carbylamines reaction, Mannich reaction, oxidation, basicity of amines.
III	**Chemistry of Nitrogen Compounds–II** **Aromatic amines** – Nomenclature, preparation – from nitro compounds, Hofmann's method; properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation. Distinction between primary, secondary and tertiary amines-aliphatic and aromatic Diazonium compounds. Diazomethane, 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.
IV	**Hetero cyclic 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.

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 Transferrable Skill

Recommended Texts:	
1	M.K. Jain, S.C. Sharma, Modern *Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.
2	S.M.Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
3	Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand & Company Pvt. Ltd., Multi colour edition, 2 012
4	P. L. Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
5	C.N. Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.
References Books:	
1	R. T. Morrison and R.N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.
2	T.W. Graham Solomons, *Organic Chemistry*, John Wile y& amp; Sons, 11th edition, 2012.
3	A. Carey Francis, *Organic Chemistry*, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, 2009.
4	I.L. Finar, *Organic Chemistry*, Wesley Longman Ltd, England, sixth edition, 1996.
5	J.A. Joule, and G.F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.

Web Resources:
1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.inVirtual Text book of Organic Chemistry

Course outcomes CO	On completion of this course, students will be able to:
CO1	Discuss the chemistry and named reactions related to carbonyl compounds and carboxylic acids
CO2	Explain preparation and properties of aromatic and aliphatic nitro compounds and amines.
CO3	Explain colour and constitution of dyes and food additives.
CO4	Discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
CO5	Discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Inorganic Chemistry - I

Title of the Course		**Inorganic Chemistry - I**					
Course Type		**CORE - VI**					
Year	**III**	**Semester**	**V**	**Credits**	**5**	**Course Code**	**24UMCH52**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	**1**		**--**	**5**	

Learning Objectives ; This course aims to provide an understanding of

LO1	Nomenclature, isomerism and theory of coordination compounds, and chelate complexes.
LO2	Crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect.
LO3	Gain knowledge on stability and mechanisms of substitution reactions of complexes.
LO4	Trace elements and their role in the biological system.
LO5	Iron transport and storage.

UNIT	CONTENTS
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 Oxine in gravimetric analysis–estimation of hardness of water using EDTA, metal ion indicators. Role of metal chelates in living systems–hemoglobin and chlorophyll.
II	**Co-ordination Chemistry-II** Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectro chemical series – calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of $[Ti(H_2O)_6]^{3+}$ - Jahn – Teller effect. (Elementary idea).Comparison of VBT and CFT.
III	**Co-ordination Chemistry-III** **Stability and reaction mechanism of complexes** Stability of metal complexes-Stability constants- Labile and inert complexes-Thermo and kinetic stability - Factors affecting the stability of complexes - Substitution reactions and Mechanism of Octahedral complexes: aquation, base hydrolysis and anation reactions - Substitution in square planar complexes - Trans effect – Theories of Trans effect - Redox reaction: Inner and outer Sphere electron transfer reactions. Preparation and uses of Prussian blue, Turnball‟s blue, Sodium nitroprusside and Nickel DMG complex.
IV	**Bioinorganic Chemistry** Essential and trace elements: Role of Na^+,K^+, Mg^{2+}, Ca^{2+}, Fe^{3+}, Cu^{2+} and Zn^{2+}in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg.
V	**Metal ion transport and storage** Iron–storage, transport-Transferrin and Ferretin; Iron-porphyrins– myoglobin, hemoglobin– oxygen transport - Bohr effect; Sodium/potassium pump, calcium pump; transport and storage-copper and zinc.

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 Transferrable Skill

Recommended Texts:

1	Puri.B.R, Sharma.L.R, Kalia.K.C. (2011), Principles of Inorganic Chemistry, 31th Edition, Milestone Publishers & Distributors, Delhi.
2	Satya Prakash, TuliG.D., Basu S.K.,Madan R.D.(2009 Advanced Inorganic Chemistry,18 Edition, S. Chand & Co., New Delhi
3	Lee JD,(1991),Concise Inorganic Chemistry,4thed., ELBS William Heinemann, London
4	WV Malik, GD Tuli, RD Madan,(2000), Selected Topics in Inorganic Chemistry, S Chand and Company Ltd.
5	A.K. De, Textbook of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992

References Books:

1	Madan RD, Sathya Prakash,(2003), Modern Inorganic Chemistry, 2nd ed. S. Chand and Company, New Delhi
2	Gopalan R,(2009) Inorganic Chemistry for Under graduates, I st Edition, University Press (India) Private Limited, Hyderabad
3	Sivasankar B, (2013) Inorganic Chemistry. 1 st Edition, Pearson, Chennai
4	Alan G. Sharp (1992),Inorganic Chemistry,3 rd Edition, Addition-Wesley, England
5	Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

Web Resources:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in

Course outcomes CO	On completion of this course, students will be able to:
CO1	Explain isomerism, Werner's Theory and stability of chelate complexes.
CO2	Discuss crystal field theory, magnetic properties and spectral properties of complexes
CO3	Compare the various substitution reactions of Coordination Compounds and deduct the stability of the complexes.
CO4	Ability to explain the importance of trace elements on biological system
CO5	Explain the metal ion transport, Bohr effect, Na, K, Ca pump.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Physical Chemistry - I

Title of the Course		**Physical Chemistry - I**					
Course Type		**CORE - VII**					
Year	**III**	**Semester**	**V**	**Credits**	**5**	**Course Code**	**24UMCH53**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	**1**		**--**	**5**	

Learning Objectives ; This course aims to provide an understanding of

LO1	Thermodynamic concepts on chemical processes and applied aspects.
LO2	Gibbs free energy, Helmholtz free energy, partial molar properties and thermochemical calculations.
LO3	Chemical equilibrium.
LO4	Chemical kinetics and different types of chemical reactions.
LO5	Photochemistry, fluorescence and phosphorescence.

UNIT	CONTENTS
I	**Thermodynamics - I** ***Terminology*** – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; ***First law of thermodynamics***– Concept and significance of heat(q), work(w), internal energy(E), enthalpy(H);calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson effect-inversion temperature. Limitations of first law ***Zeroth law of thermodynamics***–Absolute Temperature scale.

II	**Thermodynamics - II** **Second Law of thermodynamics**-, 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 Vander 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, thermodynamic equations of state; Thermodynamics of mixing of ideal gases. **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.
III	**Chemical equilibrium** Law of mass action–thermodynamic derivation–relationship between Kpand Kc – application to the homogeneous equilibria – dissociation of PCl_5 gas, N_2O_4 gas – equilibrium constant and degree of dissociation - formation of HI, and NH_3 – heterogeneous equilibrium – decomposition of solid calcium carbonate– Lechatelier principle –Van't Hoff reaction isotherm– temperature dependence of equilibrium constant – Van't Hoff reaction isochore – Clayperon equation – Clausius Clayperon equation and its applications.
IV	**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. Effect of temperature on reaction rate – temperature coefficient – concept of activation energy –Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – 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.
V	**Photochemistry** Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H_2-Cl_2, H_2-Br_2 and H_2-I_2 reactions, comparison between thermal and photo chemical reactions. Fluorescence – applications including fluorimetry – sensitized fluorescence, phosphorescence – applications – chemiluminescence and photosensitisation – examples.

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 Transferrable Skill

Recommended Texts:

1	B.R. Puri and L.R.Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co., thirty three edition, 1992.
2	Peter Atkins, and Juliode P aula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3	Arun Bahl, B.S.Bahl, G.D.Tuli Essentials of physical chemistry, 28 edition 2019,S, Chand & Co
4	J.Rajaram and J.C. Kuriacose, Thermodynamics, Shoban Lal Nagin Chandand CO., 1986.
5	S.K.Dogra and S.Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.

References Books:

1	Maron, S.H.and PruttonC.P. *Principles of Physical Chemistry,* 4^{th}ed.; The Macmillan Company: Newyork, 1972.
2	K. L. Kapoor, A Text book of Physical Chemistry, Macmillan India Ltd, third edition,2009.
3	Gilbert.W.Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985.
4	Keith.J. Laidler, Chemical kinetics, third edition, Pearson, 2003.
5	Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

Web Resources:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

Course outcomes CO	On completion of this course, students will be able to:
CO1	Explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.
CO2	Discuss the second law of thermodynamics and its application to heat engine; Discuss third law and its application on heat capacity measurement. Explain Gibbs and Helmholtz free energy functions, partial molar quantities.
CO3	Apply the concepts of chemical equilibrium in dissociation of PCl5, $N_2O_4$and formation of HI, NH_3 and decomposition of calcium carbonate. Demonstrate important principles such as Lechatelier principle, van't Hoff reaction isotherm and Clausius- Clayperon equation.
CO4	Apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction and Demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.
CO5	Utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Physical Chemistry Practical

Title of the Course	Physical Chemistry Practical						
Course Type	CORE – V- Lab						
Year	III	Semester	V	Credits	3	Course Code	24UMCHL5
Instructional Hours Per week		Lecture	Tutorial		Lab Practice		Total
		-	-		4		4

Learning Objectives : This course aims at providing knowledge on	
LO 1	Basic principles of physical chemistry experiments.
LO 2	Hands on experience in carrying out the experiments.

EXPERIMENTS

1. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent.
2. Determination of molecular weight of organic compound by transition temperature method.
3. Simple eutectic-determination of eutectic temperature and composition of naphthalene Diphenylamine or naphthalene-diphenyl system.
4. Determination of upper critical solution temperature of phenol– water system.
5. Study of the effect of impurity on CST and determination of the strength of unknown.
6. Determination of rate constant of acid catalyzed hydrolysis of an ester- methylacetate.
7. Conductometric titration of hydrochloric acid against sodium hydroxide.
8. Conductometric titration of Barium chloride against magnesium sulphate.
9. Potentiometric titration of ferrous ion against potassium permanganate.
10. Potentiometric titration of ferrous ion against potassium dichromate.
11. Determination of cell constant and molar conductance of strong electrolyte.
12. Determination of dissociation constant of acetic 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 Transferrable Skill.
Reference Books:	1. Sindhu, P.S. *Practicals in Physical Chemistry*, Macmillan India: New Delhi, 2005. 2. Khosla, B.D.Garg, V.C.; Gulati, A. *Senior Practical Physical Chemistry,* R. Chand: New Delhi, 2011. 3. Gupta, Renu, *Practical PhysicalChemistry*,1st Ed.; New Age 4. International: New Delhi, 2017.
Web resources:	https://www.vlab.co.in/broad-area-chemical-sciences

Course outcomes CO	On completion of this course, students will be able to:
CO1	Describe the principles and methodology for the practical work.
CO2	Explain the procedure, data and methodology for the practical work.
CO3	Apply the principles of phase rule and electrochemistry for carrying out the practical work.
CO4	Demonstrate laboratory skills for safe handling of the equipment and chemicals.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Biochemistry

Title of the Course		**Biochemistry**					
Course Type		**ELECTIVE - V**					
Year	**III**	**Semester**	**V**	**Credits**	**3**	**Course Code**	**24UECH51**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	**1**		**--**	**5**	

Learning Objectives ; This course aims at providing knowledge on

LO1	Relationship between biochemistry and medicine, composition of blood.
LO2	Structure and properties of amino acids, peptides, enzyme, vitamins and proteins.
LO3	Biological functions of proteins, enzymes, vitamins and hormones.
LO4	Biochemistry of nucleic acids and lipids.
LO5	Metabolism of lipids.

UNIT	CONTENTS
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.
II	**Peptides and Proteins** **Aminoacids**–Nomenclature, classification–essential and Non- essential; Synthesis–Gabriel Phthalimide, 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- **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 amino acids–general aspects of metabolism(a brief outline);urea cycle.
III	**Enzymes and Vitamins** Nomenclature and classification, characteristics, factors influencing Enzyme activity–mechanism of enzyme action–Lock and key hypothesis, Koshland's induced fi model, Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes–functions of TPP, lipoicacid, NAD, NADP FMN, FAD, pyridoxal phosphate CoA, folic acid, biotin cyanocobalamin.
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).
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)	Profession 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 Transferrable Skill

Recommended Texts:

1	Bahl.B.S.; Bhal.A, *Advanced Organic Chemistry*, 3rd ed.; S.Chand: New Delhi, 2003
2	Shanmugam.A, *Fundamentals of Biochemistry for Medical Students*, 6th ed.; Published by the author, 1999.
3	Veerakumari.L, *Biochemistry*, 1st ed.; MJP Publications: Chennai, 2004.
4	Jain. J.L.; *Fundamentals of Biochemistry*, 2nd ed.; S.Chand: New Delhi, 1983.

References Books:

1	Conn. E.E.; Stumpf. P.K, *Outline of Biochemistry*,5thed.; Wiley Eastern: New Delhi, 2002.
2	West. E.S.; Todd, W.R.; Mason, H.S.; VanBruggen. J.T, Text Book of Biochemistry, 4th ed.; Macmillan: New York, 1970.
3	Lehninger. A.L, *Principles of Biochemistry*, 2nd ed.; CBS Publisher: Delhi, 1993.
4	Rastogi,.S.C,*Biochemistry*,2nd ed.;TataMcGraw-Hill:NewDelhi,2003
5	Chatterjee. M.N. Shinde. R., *Textbook of Biochemistry*,5thed.; Jaypee Brothers: New Delhi, 2002

Web Resources:

1. http://library.med.utah.edu/NetBiochem/nucacids.html
   http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html
2. https://swayam.gov.in/courses/4384-biochemistryBiochemistry
3. https://onlinecourses.nptel.ac.in/noc19_cy07/previewExperi mental Biochemistry

Course outcomes CO	On completion of this course, students will be able to:
CO1	Explain molecular logic of living organisms, composition of blood and blood coagulation.
CO2	Explain synthesis and properties of amino acids determination of structure of peptides and proteins.
CO3	Explain factors influencing enzyme activity and vitamins as coenzymes.
CO4	Explain RNA and DNA structure and functions
CO5	Explain biological significance of simple and compound lipids.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Nano Science

Title of the Course		**Nano Science**					
Course Type		**ELECTIVE - V**					
Year	**III**	**Semester**	**V**	**Credits**	**3**	**Course Code**	**24UECH52**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	**1**		**--**	**5**	

Learning Objectives ; This course aims at providing knowledge on

LO1	Introduction to nanoparticles/clusters and nanocomposites.
LO2	Properties of nanomaterials.
LO3	Characterization of nanomaterials by different methods.
LO4	Synthesis of carbon nanotubes, graphene, quantumdots, self- assembled nanomaterials.
LO5	Applications of nanomaterials as sensors.

UNIT	CONTENTS
I	**Introduction to nano science** Definition of terms– nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in frees pace, bulk material and nanomaterials. **Synthesis and stabilization of nanomaterials** ***Top down approach (physical methods)-*** mechanical dispersion– ball milling, methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis- nano lithography. ***Bottom–up approach (chemical methods)*** – solvo thermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes- solvents reducing agents, Capping agents-stabilization of nanoparticles-electrostatic and steric stabilization, common stabilizers, nanoparticle growth in solution, Template growth.
II	**Properties of materials on a nanoscale** Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), Quantum confinement effect, tuning of optical spectrum. Magnetic properties-Fe_3O_4 particle, supramagnetic properties, electronic properties, Chemical properties-chemical process on the surface of nanoparticles, catalysis, mechanical properties
III	**Techniques employed for characterisationof nanomaterials** Spectrocopy–UV-visible, Photoelectron spectroscopy–Electron microscopy–Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM)– Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy–confocal microscopy, X-ray diffraction (XRD) Principle and Block diagram (only)
IV	**Special nanomaterials** ***Carbon Nano Structures Carbon nanotubes***: Introduction-types-zigzag, Armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission, Fuel Cells, Display devices. Other Important Carbon based materials Preparation and Characterization Fullerene, Graphene, properties, DLC and Nano diamonds and Applications ***Semiconductor nanoparticles***: Quantum dots, synthesis–chemical Synthesis using clusters, properties, porous silicon–electrochemical etching, aerogel–types– silica aerogel, resorcinol formaldehyde (RF) aerogels, zeolites– applications Self Assembled **Nanomaterials:** Self Assembled Monolayers (SAMS)– inorganic, organic molecules.

V	**Application of nanomaterials *Biomedical Applications*-** Drug, drug delivery, bio labelling, artificial implants, cancer treatment. Sensors– Natural nanoscale sensors, Chemical sensors, biosensors, electronic noses. ***Optics & Electronics*–** Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, and quantum dot laser Single electron transistors [SET]. ***Nano technology in agriculture*–**Fertilizer and pesticides nanomaterials For water purification, nanomaterials in food and packaging materials Fabric industry. Impacts of Nanotechnology– human & environmental safety risks

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 Transferrable Skill

Recommended Texts:

1	Sulabha K.Kulkarni, *Nano technology: Principles and Practices*, Capital Publishing Co., New Delhi.
2	Pradeep. T, *Nano: The Essentials, Understanding Nanoscience and Nano technology*; Tata McGraw-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, Baldev Raj.; Rath. B.B. James Murday, *Textbook of Nanoscience and Nanotechnology*; Universities press, India Ltd, Hyderabad. 2012.

References Books:

1	Sharma. P.K., *Understanding Nanotechnology*; Vista International Publishing House, Delhi. 2008.
2	Charles P. Poole Jr.; Frank J. Owens. *Introduction to Nanotechnology;* AJohn Wiley & Sons, INC., Publication, 2003.
3	Viswanathan B., *Nano Materials;* Naros a Publishing House, New Delhi, 2009
4	Edited by C.N.R. Rao; Muller. A; Cheetham. A.K. *Nanomaterials Chemistry Recent Developments and New Directions*, WILEY- VCH Verlag GMBH & Co.,KGaA, Darmstad
5	Jing Zhong Zhang, *Optical properties and spectroscopy of Nanomaterials*; World Scientific Publishing Pvt.Ltd., Singapore.

Web Resources:	
	1. http://www.nanotechnology.com/docs/wtd015798.pdf 2. http://nccr.iitm.ac.in/Nanomaterials.pdf
Course outcomes CO	**On completion of this course, students will be able to:**
CO1	Explain the general concepts and physical phenomena of relevance within the field of nanoscience.
CO2	Describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.
CO3	Examine the structure, properties, applicability and characterization of nanomaterials.
CO4	Analyze various synthesis procedures, characterizations and uses of carbon nanotubes, f ullerene and grapheme.
CO5	Discuss applications of nanomaterials of sensors and in optics and electronics.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Industrial Chemistry

Title of the Course		**Industrial Chemistry**					
Course Type		**ELECTIVE - VI**					
Year	**III**	**Semester**	**V**	**Credits**	**3**	**Course Code**	**24UECH53**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**		**Total**
		4	**1**		**--**		**5**

Learning Objectives ; This course aims at providing knowledge on

LO1	Classifications and characteristics of fuels.
LO2	Preparation of cosmetics.
LO3	Manufacture of sugar, paper, leather and food processing.
LO4	Applications of abrasives and otherindustrial products.
LO5	Intellectual propertyrights.

UNIT	CONTENTS
I	**Survey of Indian Industries and mineral resources in India Fuels:** Classification, characteristics of fuels. ***Solid fuels***: coal - classification; analysis of coal-proximate analysis and ultimate analysis; calorific value - determination, carbonization of coal. ***Liquid fuels***: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number. ***Gaseous fuel:*** advantages over solid and liquid fuels; water gas, producer gas, carbureted water gas - preparations-uses. Natural gas: LPG-composition, advantages, application; gobar gas- production, composition, advantages, application. Propellants – rocket fuels (basic idea).
II	**Cosmetics** ***Skin care***: powders, ingredients; creams and lotion-cleansing, moisturising, all-purpose shaving cream, sunscreen; make up preparations. ***Dental care***: toothpastes–ingredients ***Hair care***: shampoos- types, ingredients; conditioners- types, ingredients. ***Perfumes***: natural–plant origin–parts of the plant used, chief constituents; animal origin - amber gris, civetone and musk; synthetic classification- esters – amyl salicylate alcohols - citronellol; terpeneols - gereniol and nerol; ketones - muskone, coumarin; aldehydes – vanillin.
III	**Sugar Industry** Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar. **Food Preservation and processing** Food spoilage–causes; Food preservation–methods–high temperature, low temperature, drying, radiation; Food additives – preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius.
IV	**Abrasives** Definition, characteristics, types - natural and synthetic; **Natural abrasives** – diamond, corundum, emery, garnet, quartz – composition, uses; **Synthetic abrasives** – carborundum, aluminium carbide, boron carbide, boron nitride, synthetic graphite – composition and uses. **Leather Industry** Structure and composition of skin, hide; Manufacture of leather– pre- tanning process – curing, liming, beating, pickling; methods of tanning- vegetable, chrome–one bath, two bath process; finishing. **Paper Industry** Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper.

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

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 Transferrable Skill
Recommended Texts:	
1	Sharma, B.K. *Industrial Chemistry*, 9th ed.; Goel Publishing House: Meerut, 1998.
2	Wilkinson. J. B. E, Moore.R. J, *Harry's Cosmeticology*, 7th ed.; Chemical Publishers: New York, 1982.
3	Alex.V.Ramani, *Food Chemistry,* MJP publishers: Chennai,2009
4	Jayashree Ghosh, *Applied Chemsitry*,S.Chand:NewDelhi,2006
5	Srilakshmi, B.*Food Science*, 4th ed., New Age International Publication, 2005.
References Books:	
1	Jain.P.C. Jain.M, *Engineering Chemistry*, 16th ed.; Dhanapet Rai: Delhi, 1992.
2	George Howard, *Principles and Practice of Perfumes and Cosmetics*, Stanley Therones, Cheltenham: UK, 1987.
3	Thankamma Jacob, *Foods, Drugs and Cosmetics-A Consumer Guide*, Macmillan : London, 1997.
4	Shankuntala Manay. N.; Shadakshara swamy. M, *Food Facts and Principles*, 3rd ed.; New Age Publication, 2008.
5	Neeraj Pandey, Khushdeep Dharni ,*Intellectual Property Rights*, PHI Learning, 2014.
Web Resources:	
1. http://www.sciencecases.org/irradiation/irradiation_notes.asp 2. http://discovery.kcpc.usyd.edu.au//9.5.5/ 3. https://www.wipo.int/about-ip/en/ 4. www.nptel.ac.in 5. http:/swayam.gov.in	

Course outcomes CO	On completion of this course, students will be able to:
CO1	Summarize the properties of fuels which include petroleum, water gas natural gas and propellants.
CO2	Evaluate cosmetic products.
CO3	Explain manufacture of sugar, food spoilages and food additives.
CO4	Explain properties of abrasives, manufacture of leather and paper.
CO5	Explain Intellectual property rights.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Pharmaceutical Chemistry

Title of the Course		Pharmaceutical Chemistry					
Course Type		ELECTIVE - VI					
Year	III	Semester	V	Credits	3	Course Code	24UECH54
Instructional Hours Per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		

Learning Objectives ; This course aims at providing knowledge on

LO1	Drugs design and drug metabolism
LO2	Important Indian medicinal plants, common diseases and antibiotics
LO3	Drugs for major diseases like cancer, diabetes and AIDS
LO4	Analgesics and antipyretic agents
LO5	Significance of clinical tests

UNIT	CONTENTS
I	**Introduction** Important terminologies – drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmaco therapeutics, 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 to drugs–drug design by method of variation–disjunction and conjunction methods.

II	**Indian medicinal plants** Some important Indian medicinal plants– tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai –uses. **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.
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 tolazolinehydrochloride, sodium nitro prusside. AIDS–causes, Symptoms and prevention–anti HIV drugs-AZT, DDC.
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-generalanaesthetics–volatile anesthetics – nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloroethylene storage, advantages and disadvantages; nonvolatile anesthetics – thiopental sodium ; local anesthetics – requisites – advantages-esters cocaine, benzocaine; amides– lignocaine, cinchocaine. **Blood and haemotological agents** Blood– composition, grouping – physiological functions of plasmaproteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, dry thrombin; Anti-coagulants – coumarins, citric acid and heparin; anti fibrinolytic agents – amino caproic acid and tranexamic acid. Anaemia–causes, types and control–anti anemic drugs.

V	**Clinical Chemistry** Blood tests–blood count–complete haemotogram – Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time–-glucose tolerance test. **Significance of Clinical Tests** Serum electrolytes-blood Glucose-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, H DL ,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 Transferrable Skill

Recommended Texts:

1	Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S. Chand& company, New Delhi.
2	Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultan Chand & sons, Delhi.
3	Tripathi KD, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi.
4	Ashutosh Kar, (2018),Medicinal chemistry,7thed., Newage international (P) Limited, Publishers, NewDelhi.

References Books:

1	Chatwal GR, (1991), Pharmaceutical chemistry, organic (vol-II). Himalaya publishing house, Bombay.
2	Chatwal GR, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6th ed., Himalaya Publishing house, Bombay.
3	Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi.
4	Intellectual Property Rights, Neeraj Pandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896.

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

Course outcomes	On completion of this course, students will be able to:
CO1	Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.
CO2	Discuss the development of drugs, structural activity, disease types, physio-Chemical properties of therapeutic agents, significance of medicinal plants, clinical tests and factors for patentability.
CO3	Apply the principles involved in structural activity and drug designing, functions of haematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.
CO4	Explain classification of analgesics and anesthetics, and physiological functions of plasma proteins.
CO5	Explain the significance of clinical tests like blood urea, serum proteins and coronary risk index.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) M-Medium (2) L-Low (1)

CO/ PSO	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

Personality Development

Title of the Course		**Personality Development**			
Course Type		**Indian Knowledge System (IKS)**			
Course Code		**24UPDT51**			
Year	**III**	**Semester**	**V**	**Credits**	**2**
Instructional Hours Per week		**Lecture**	**Tutorial**	**Lab Practices**	**Total**
		1	**1**	**--**	**2**

UNIT – I

Personality - Definition – Determinants – Personality Traits –Theories of Personality – Importance of Personality Development. Self-Awareness – Meaning – Benefits of Self – Awareness – Developing Self – Awareness. SWOT – Meaning – Importance- Application – Components. Goal Setting Meaning- Importance – Effective goal setting – Principles of goal setting – Goal setting at the Right level.

UNIT – II

Self-Monitoring – Meaning – High self – monitor versus low self-monitor – Advantages and Disadvantages self-monitor- Self –monitoring and job performance. Perception- Definition- Factor influencing perception- Perception process –Errors in perception – Avoiding perceptual errors. Attitude – Meaning- Formation of attitude – Types of attitude - Measurement of Attitudes – Barriers to attitude change – Methods to attitude change. Assertiveness - Meaning – Assertiveness in Communication – Assertiveness Techniques – Benefits of being Assertive – Improving Assertiveness.

UNIT – III

Team Building – Meaning – Types of teams – Importance of Team building- Creating Effective Team. Leadership – Definition – Leadership style- Theories of leadership – Qualities of an Effect leader. Negotiation Skills – Meaning – Principles of Negotiation – Types of Negotiation – The Negotiation Process – Common mistakes in Negotiation process. Conflict Management – Definition- Types of Conflict- Levels of Conflict – Conflict Resolution – Conflict management.

UNIT –IV

Communication – Definition – Importance of communication – Process of communication - Communication Symbols – Communication network – Barriers in communication – Overcoming Communication Barriers. Transactional Analysis – Meaning – Ego States – Types of Transactions – Johari Window- Life Positions. Emotional Intelligence- Meaning – Components of Emotional Intelligence- Significance of managing Emotional intelligence – How to develop Emotional Quotient. Stress Management – Meaning – Sources of Stress – Symptoms of Stress – Consequences of Stress – Managing Stress

UNIT – V

Social Graces – Meaning – Social Grace at Work – Acquiring Social Graces. Table Manners – Meaning – Table Etiquettes in Multicultural Environment- Do's and Don'ts of Table Etiquettes. Dress Code – Meaning- Dress Code for selected Occasions – Dress Code for an Interview. Group Discussion – Meaning – Personality traits required for Group Discussion- Process of Group Discussion- Group Discussion Topics. Interview – Definition- Types of skills – Employer Expectations –Planning for the Interview – Interview Questions- Critical Interview Questions.

References:

1. Dr. S. Narayana Rajan, Dr. B. Rajasekaran, G. Venkadasalapthi, V. Vijuresh Nayaham and Herald M.Dhas, **Personality Development**, Publication Division, Manonmaniam Sundaranar University, Tirunelveli
2. Stephan P.Robbins, **Organisational Behaviour**, Tenth Edition, Prentice Hall of India Private Limited, New Delhi,2008
3. Jit S. Chandan, **Oragnisational Behaviour**, Third Edition, Vikas Publishing House Private Limited, 2008
4. Dr.K.K. Ramachandran and Dr.K.K. Karthick, **From Campus to Corporate**, Macmillan Publishers India Limited, New Delhi, 2010.

Semester - VI
Organic Chemistry - II

Title of the Course		**Organic Chemistry - II**					
Course Type		**CORE - VIII**					
Year	**III**	**Semester**	**VI**	**Credits**	**4**	**Course Code**	**24UMCH61**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	**1**		**--**	**5**	

Learning Objectives ; This course aims to provide an understanding of	
LO1	Stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane.
LO2	Classification, isolation and discussing the properties of alkaloids and terpenes.
LO3	Different molecular rearrangement.
LO4	Preparation and properties of organometallic compounds.
LO5	Principles of pericyclic and photochemistry.

UNIT	CONTENTS
I	**Stereochemistry** Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations. **Optical Isomerism:** Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures–molecules with one and two chiral centres, racemization –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, spiranes Conformational analysis of ethane, propane, butane, Ethylene glycol and 1,2 dichloro butane

II	**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.
III	**Molecular rearrangements:** Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone, Wagner-Meerwin, Benzilic acid and Lossen rearrangement
IV	**Reagents in organic synthesis** DMSO, DIBAL, NBS/NCS, PCC, PDC, I_2/Silver acetate, $KMnO_4$, $NaBH_4$, $LiAlH_4$, Na/liq.NH_3, Na-Hg/HCl, NH_2-NH_2/OH^- and DDQ, SeO_2, MnO_2, OsO_4, LTA, HIO_4, $HgSO_4$/ H_2SO_4, BH_3 **Organometallic compounds in Organic Synthesis** Preparation, Properties and applications -Grignard Reagents, Organo Lithium Compounds, Ziegler–Natta catalyst, and Wilkinson catalyst.
V	**Pericyclic and Photochemistry:** Pericyclic Reactions: Classifications - Concerted reactions - Orbital symmetry and Concerted symmetry - Woodward and Hoffmann rules Selection rules for electrocyclic and cycloaddition reactions, Sigmatropic rearrangements- Claisen and Cope. Introduction to organic photochemistry - Basic concepts, Photoreactions of ketones - Norrish Type I and II reactions - Paterno- Buchi reaction.

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 Transferrable Skill

Recommended Texts:	
1	M.K.Jain, S.C.Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.
2	S.M.Mukherji,and S.P.Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
3	Arun Bahl and B.S.Bahl, Advanced organic chemistry, NewDelhi, S.Chand&CompanyPvt.Ltd.,Multi colour edition,2 012
4	P. L. Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
5	C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.
References Books:	
1	R. T. Morrison and R.N. Boyd, Organic Chemistry, Pearson Education, Asia, sixthedition, 2012.
2	T.W. Graham Solomons, *Organic Chemistry*, John Wile y& amp; Sons, 11th edition, 2012.
3	A.Carey Francis, *Organic Chemistry*,Tata McGraw-Hill Education Pvt., Ltd.,New Delhi, seventh edition, 2009.
4	I.L. Finar, *Organic Chemistry*, Wesley Longman Ltd, England, sixth edition, 1996.
5	Organic Pericyclic and Photochemistry, Jegadamba singh
Web Resources:	
1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3.http:/swayam.gov.in 3. Virtual Text book of Organic Chemistry	

Course outcomes	On completion of this course, students will be able to:
CO1	Assign R S notations to chirals and E Z notations to olefins and explain conformations of ethane and butane
CO2	Explain isolation and properties of alkaloids and terpenes
CO3	Explain molecular rearrangements like benzidine, Hoffmann etc.,
CO4	Discuss preparation and properties of organo lithium compounds
CO5	Understand and apply the principles of pericyclic and Photochemical reactions.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Inorganic Chemistry - II

Title of the Course		**Inorganic Chemistry - II**					
Course Type		**CORE IX**					
Year	**III**	**Semester**	**VI**	**Credits**	**4**	**Course Code**	**24UMCH62**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	**1**		**-**	**5**	
Learning Objectives ; This course aims to provide an understanding of							
LO1	Metalloenzymes, oxygen transport.						
LO2	Preparation and properties of metal carbonyls.						
LO3	Preparation and properties of inorganic polymers.						
LO4	Silicates and their applications.						
LO5	Industrial applications of refractories, alloys, paints and pigments.						

UNIT	CONTENTS
I	**Metallo enzymes** Isomerase and synthetases, structure of cyanocobalamin (Vitamin B_{12}), nature of Co-C bond; Metallo enzymes - functions of carboxy peptidase A, zinc metallo enzyme – mechanism and uses, Zn-Cu enzyme – structure and function, carbonic anhydrase, Vitamin B_{12} as transferase and isomerase - Invivo and Invitro nitrogen fixation.
II	**Organometallic compounds Metal Carbonyls** Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls– structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls.
III	**Inorganic polymers** General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) – preparation and properties of silicones (poly dimethyl siloxane and poly methyl hydro siloxane) phosphorous based polymer (polyphosphazines and polyphophonitrilic chloride), sulphur based polymer (poly sulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – Industrial applications of inorganic polymers.
IV	**Silicates** Introduction – general properties of silicates, structure – types of silicates – ortho silicates (zircon), pyrosilicates (thortveitite), chain silicates (pyroxenes), ring silicates (beryl), sheet silicates (talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines) constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti- skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels.
V	**Industrial Applications of Inorganic Compounds** Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification.

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 Transferrable Skill

Recommended Texts:

1	Puri.B.R, Sharma.L.R, Kalia.K.C. (2011), Principles of Inorganic Chemistry, 31th Edition, Milestone Publishers & Distributors, Delhi.
2	SatyaPrakash,TuliG.D., Basu S.K.,Madan R.D.(2009), Advanced Inorganic Chemistry,18 Edition, S. Chand & Co., New Delhi
3	Lee JD,(1991),Concise Inorganic Chemistry,4thed.,ELBS William Heinemann, London
4	WV Malik, GD Tuli, RD Madan,(2000), Selected Topics in Inorganic Chemistry, S Chand and Company Ltd.
5	A.K.De, Textbook of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992

References Books:

1	Madan RD, Sathya Prakash,(2003), Modern Inorganic Chemistry, 2nd ed. S.Chand and Company, New Delhi
2	Gopalan R,(2009)Inorganic Chemistry for Under graduates, 1 st Edition, University Press (India)Private Limited, Hyderabad
3	Sivasankar B, (2013) Inorganic Chemistry. 1 st Edition, Pearson,Chennai
4	Alan G.Sharp (1992),Inorganic Chemistry,3 rd Edition, Addition-Wesley, England
5	Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

Web Resources:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

Course outcomes CO	On completion of this course, students will be able to:
CO1	Explain the function of Vitamin B12, Zn-Cu enzyme, ferredoxin, cluster enzymes
CO2	Explain preparation and properties of metal carbonyls
CO3	Explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous.
CO4	Classify and explain structure of silicates
CO5	Explain the manufacture of refractories, explosives ,paints and pigments

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Physical Chemistry - II

Title of the Course		**Physical Chemistry - II**					
Course Type		**CORE X**					
Year	**III**	**Semester**	**VI**	**Credits**	**4**	**Course Code**	**24UMCH63**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	**1**		**--**	**5**	

Learning Objectives ; This course aims to provide an understanding of

LO1	Phase diagram of one and two component systems
LO2	Separation techniques for binary liquid mixtures
LO3	Electrical conductance andtransport number.
LO4	Galvanic cells, EMF and significance of electrochemical series.
LO5	Applications of EMF measurements

UNIT	CONTENTS
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), freezing mixtures (potassium iodide- water), compound formation with- congruent melting points (magnesium–zinc and ferric chloride– water system).
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.

III	**Electrical Conductance and Transference** Arrhenius theory of electrolytic dissociation – Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device), transport number–determination–Hittorf's method, moving boundary method–factors affecting transport number – determination of ionic mobility; Kohlrausch's law- applications; molar ionic conductance and viscosity (Walden's rule); applications of conductance measurements–determination of-degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility and solubility product of sparingly soluble salts-conductometric titrations–acid base titrations.
IV	**Galvanic Cells and Applications** Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement–standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction, Thermodynamics and EMF–calculation of ΔG, ΔH, and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes–metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electro chemical series. Chemical cells with and without transport, concentration cells with and without transport.
V	**Applications of EMF measurements** Applications of EMF measurements–determination of activity Coefficient of electrolytes, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations - redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate. **Industrial component** Galvanic cells - lead storage, Ni-Cd, Li and Zn-air, Al-air batteries. Fuel cells – H_2-O_2 cell – efficiency of fuel cells.

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 Transferrable Skill

Recommended Texts:	
1	B.R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co., thirty three edition, 1992.
2	Peter Atkins, and Juliode Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3	ArunBahl, B.S. Bahl, edition 2019, S, Chand & Co G.D.Tuli Essentials of Physical chemistry,28th
4	J.Rajaram and J.C.Kuriacose, Thermodynamics, Shoban Lal Nagin Chandand CO., 1986.
5	S.K.Dogra and S.Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
References Books:	
1	Maron, S.H. and PruttonC.P. *Principles of Physical Chemistry,* 4th ed.; The Macmillan Company, Newyork, 1972.
2	K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009.
3	Gilbert.W.Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985.
4	Keith.J.Laidler, Chemical kinetics, third edition, Pearson, 2003.
5	Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Web Resources:	
1	https://nptel.ac.inhttps://swayam.gov.inhttps://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/ PPTs/MTS_07_m
2	Pdf Thermodynamics - NPTEL https://www.youtube.com/watch?v=f0udxGcoztE Introduction to chemical equilibrium–MIT open course ware

Course outcomes CO	On completion of this course, students will be able to:
CO1	Construct the phasediagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.
CO2	Identify an appropriate distillation method for binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids
CO3	Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.
CO4	Construct electrochemical cell with the help of electrochemical Series and calculate cell EMF.
CO5	Demonstrate the applications of EMF and significance of potentiometric titrations

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Project with viva-voce

Title of the Course		**Project with viva-voce**					
Course Type		**PROJECT**					
Year	**III**	**Semester**	**VI**	**Credits**	**3**	**Course Code**	**24UMCHP1**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		--	**--**		**5**	**5**	
Objectives of the course		• To reinforce the concepts with analytical techniques • To provide a platform for students to have hands-on experience with instruments					
Course outline		Students will be divided into groups. As a group, students will do the project work on a title approved by the respective project supervisor. Students will maintain daily records and present oral reports while doing the project. All the above process will be duly assessed by the project supervisor. They will submit the project report at the end of the semester.					

Fundamentals of Spectroscopy

Title of the Course		**Fundamentals of Spectroscopy**					
Course Type		**ELECTIVE - VII**					
Year	**III**	**Semester**	**VI**	**Credits**	**3**	**Course Code**	**24UECH61**
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	**1**		**--**	**5**	

Learning Objectives ; This course aims at providing an overall view of

LO1	Electrical and magnetic properties of organic and inorganic compounds.
LO2	Basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry.
LO3	Instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry.
LO4	Application of various spectral techniques in structural elucidation.
LO5	Solving combined spectral problems.

UNIT	CONTENTS
I	**Electrical and Magnetic properties of molecules** Dipole moment – polar and non-polar molecules – polarisability of molecules. Application of dipole moments in the study of organic and inorganic molecules. Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism– determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti-ferromagnetism. **Microwave spectroscopy** Rotation spectra- diatomic molecules (rigid rotator approximation) selection rules–determination of bond length, effect of isotopic substitution–instrumentation and applications.
II	**Ultraviolet and Visible spectroscopy** Electronic spectra of diatomic molecules (Born Oppenheimer approximation)-vibrational coarse structure–rotational fine structure of electronic vibration transitions – Frank Condon principle – dissociation in electronic transitions – Birge Sponer method of evaluation of dissociation energy–pre-dissociation transition-σ-σ*, π-π*,n-σ*, n-π* transitions. Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α, β-unsaturated ketones. Elementary Problems. Colorimetry –principle and applications (estimation of Fe3+).
III	**Infrared spectroscopy** Vibration spectra–diatomic molecules–harmonic oscillator and An harmonic oscillator; Vibration–rotation spectra–diatomic molecule as rigid rotator and an harmonic 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). **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.
IV	**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 neighbouring protons in vinyl and allyl systems.
V	**Mass spectrometry** Principle–different kinds of ionisation–instrumentation–the mass spectrum–types of ions–determination of molecular formula- Fragmentation and structural elucidation–Mc Lafferty rearrangement; Retro Diels Alder reaction-illustrations with simple organic molecules. Solving structure elucidation problems using multiple spectroscopic Data (NMR, MS, IR and UV-Vis).

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 Transferrable Skill

Recommended Texts:

1	Gopalan, R. Subramaniam, P.S. Rengarajan, K. *Elements of Analytical Chemistry*; S Chand: New Delhi, 2003.
2	Usharani, S.*Analytical Chemistry*, 1st ed.; Macmillan: India, 2002
3	Banwell, C.N. Mc Cash, E. M. *Fundamentals of Molecular Spectroscopy*, 4th ed.; Tata McGraw Hill, New Delhi, 2017.
4	U.N. Dash, Analytical Chemistry Theory and Practice, Sultan Chand & Sons, 2nd Ed., 2005
5	B.K. Sharma, Spectroscopy, 22nd ed., Goel Publishing House, 2011

References Books:

1	Srivastava, A.K.; Jain, P.C. *Chemical Analysis an Instrumental Approach*, 3rd ed.; S. Chand, New Delhi, 1997.
2	Robert D Braun. *Introduction to Instrumental Analysis*; Mc.Graw Hill: New York, 1987.
3	Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. *Fundamentals of Analytical Chemistry*, 9th ed.; Har court college Publishers: USA, 2013.
4	Madan, R.L.; Tuli, G.D. *Physical Chemistry*, 2nd ed.; S.Chand: New Delhi, 2005.
5	Puri, B.R.; Sharma, L.R.; Pathania, M.S.*Principles of Physical Chemistry*, 43rd ed.; Vishal Publishing: Delhi, 2008.

Web Resources:

1. http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf
2. http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.htm
3. www.epgpathshala.nic.in
4. www.nptel.ac.in
5. http:/swayam.gov.in

Course outcomes CO	On completion of this course, students will be able to:
CO1	Explain electrical and magnetic properties of materials and microwave spectroscopy
CO2	Explain theory, instrumentation and applications of Infrared and Raman spectroscopy
CO3	Apply selection rules to understand spectral transitions, explain Woodward– Fieser's rule for the calculation of wavelength maximum of conjugated dienes
CO4	Explain theory, instrumentation and applications of NMR spectroscopy
CO5	Explain theory, instrumentation and applications of Mass spectrometry

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Green Chemistry

Title of the Course		Green Chemistry					
Course Type		ELECTIVE - VII					
Year	III	Semester	VI	Credits	3	Course Code	24UECH62
Instructional Hours Per week		Lecture	Tutorial		Lab Practice	Total	
		4	1		--	5	

Learning Objectives ; This course aims at providing an overall view of	
LO1	The needs of green chemistry.
LO2	The uses of green solvents.
LO3	The efficiency of green catalysts.
LO4	Green reactions.
LO5	Green energies.

UNIT	CONTENTS
I	**INTRDUCTON TO GREEN CHEMISTRY AND PRINCIPLES OF GREEN CHEMISTRY** **Introduction** Sustainable development- Definition of Green Chemistry- Need and goal of Green Chemistry- Twelve Principles of Green Chemistry with their explanation. **Efficiency Parameters**: Reaction Yield, Atom economy, Conversion factors, Reaction selectivity and Environmental Load factor (E- Factor). **Atom Economic reactions** : (i) Rearrangement reactions(100% atom economy), (ii) Addition reactions (100% atom economy), (ii) Elimination reactions (100% atom economy).
II	**GREEN SOLVENTS** **Super Critical Fluids:** Introduction- Extraction of super critical fluids- Solvents of super critical fluids – Advantages and Applications. **Super Critical Carbon dioxide:** Preparation, Properties, Advantages and Applications. 15. **Super Critical Water:** Reactions in water and Near critical water (NCW)- Region. Extracting natural products-Dry Cleaning super critical polymerization, Hydrogenation and Hydroformylation. **Ionic Liquids:** Introduction – Synthesis of Ionic liquids- Acidic ionic liquid and Neutral ionic liquids and Applications in organic synthesis.

III	**GREEN CATALYSTS** **Different types of Catalysts** **Acid Catalyst-Base catalyst** – Oxidation catalyst – Polymer supported catalysts – Photo sensitized super acid catalyst and Tetra Amido Macrocylic Ligand (TAML) catalyst. **Biocatalyst:** Microbial Oxidation, Reduction, Enzyme catalysed hydrolytic process perfluorinated catalyst and biocatalyst.
IV	**GREEN REACTIONS** **Microwave Assisted Green Synthesis:** **Microwave Assisted reactions in water**: Hoffman Elimination, Hydrolysis of Benzyl chloride and Methyl benzoate - Oxidation of toluene and alcohol. **Microwave Assisted Reactions in Organic Solvents:** Esterification, Fries rearrangement, Claisen rearrangement, Diels‟s Alder reaction and Decarboxylation. **Ultrasound Assisted Reactions:** Esterification, Saponification, Alkylation, Oxidation, Reduction, Coupling reactions and Cannizaro reactions.
V	**GREEN ENERGY** **Green Energy**: Definition and Types of Green energy. **Biomass Energy**: Sources of Biomass – Bio gas Generation- Biofuel (Biodiesel). **Solar energy**: Sun and solar energy –Storage, Photovoltaic system, Applications of solar energy. **Hydrogen energy:** Hydrogen production, Hydrogen storage and Application. **Wind energy:** Importance and uses. " Green Chemistry. An Introductory Text", 2nd Ed., RSC Publishing, 2010.

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 Transferrable Skill

Recommended Texts:	
1	Green Chemistry: Theory and Practice, P. T. Anatas and J. C. Warner, Oxford University Press, New York, 1998
2	Real World Cases in Green Chemistry, M.C. Cann and M.E. Connelly, American Chemical Society 2000.
3	V. Kumar, "An Introduction to Green Chemistry" Vishal Publishing Co. Reprint Edition, 2010
References Books:	
1	Green Chemistry: Environmental Friendly Alternatives. R.S. Sanghi and M.M. Srivasta, Alpha International Science, 2003.
2	Green Chemistry for Environmental Remediation, R.Sanshi, V.Sing, Wiley, 2012.
3	Rashmi Sanghi, M.M. Srivastava " Green Chemistry" Fourth Reprint, 2009.

Course outcomes CO	On completion of this course, students will be able to:
CO1	Apply the Principles of Green Chemistry in various reactions
CO2	Assess the quality of green solvents in Chemical process
CO3	Explain the efficiencies of green catalyst
CO4	Distinguish the Problems of Ordinary reactions and Green reactions
CO5	Illustrate the importance of green energy technology

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Polymer Science

Title of the Course		Polymer Science					
Course Type		ELECTIVE - VIII					
Year	III	Semester	VI	Credits	3	Course Code	24UECH63
Instructional Hours Per week		Lecture	Tutorial		Lab Practice	Total	
		4	1		--	5	

Learning Objectives ; This course aims at providing knowledge on	
LO1	Classification of polymers, preparation of polymers
LO2	Types of polymerization and characterization of polymers
LO3	Analyticaltechniques used to characterize polymers
LO4	Reactions of polymers
LO5	Speciality polymers like PVC, PMMA

UNIT	CONTENTS
I	**Introduction** Difference between polymer and macromolecule– classification– Synthetic and natural, organic and inorganic, thermoplastic and Thermosetting Plastics, elastomers, fibres and liquid resins. **Techniques of polymerization** Bulk, Solution, Emulsion and Suspension polymerization
II	**Types of polymerization** Condensation and addition polymerisation; ionic, free radical, copolymerization and coordination polymerisation–reactivity Ratios–block and graft copolymers. **Characterisation of polymers** Appearance, feel and hardness, density, effect of heat, solubility, combustion, Thermal properties of polymers–Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing glass Transition Temperature, Importance of Glass Transition Temperature, Heat Distortion Temperature, TGA/ DTA,
III	**Molecular Weight and Properties of Polymers** Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight, poly dispersity index – membrane and vapour phase Osmometry, light scattering – Zimmplot, ultracentrifuge– sedimentation velocity and sedimentation equilibrium–viscometry – gel permeation chromatography. Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity

IV	**Polymer technology** Processing of polymers–casting, thermoforming, moulding– extrusion, compression, blow moulding– foaming ,lamination, reinforcing–processing of fibres– melt, wet and dry spinning.
V	**Speciality polymers** Conducting polymers, biomedical polymers, electro luminescent polymers–two examples of each of these polymers, Polyethylene, PVC, PMMA, polyester; Rubber–synthetic and natural, Vulcanisation of rubbers. **Polymer Degradation** Types of Degradation-Thermal, Mechanical, Ultra sound, Photo degradation and Chemical Degradation Methods. Biodegradable and Non-Biodegradable 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, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts:

1	Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer Science. NewDelhi:NewAgeInternational,2015
2	Misra G.S. Introductory Polymer Chemistry. New Delhi: Wiley Eastern, 2010.
3	Bahadur Pand Sastry NV. Principles of Polymer Science. New Delhi: Narosa Publishing House, 2005
4	Ahluwalia, V.K. Anuradha Mishra, *Polymer Science A Text Book*, An e Books India: New Delhi, 2008.
5	Morrison, R.R.; Boyd, R.N.; Bhattacharjee, S.K. *Organic Chemistry*, 7th ed.; Pearson: New Delhi, 2011.

References Books:

1	Billmeyer, F.W. Polymer Science.India:Wiley-Interscience,2007
2	Seymour, R. B.; CarraherJr.C.E. *Polymer Chemistry: An Introduction,* Marcel Dckker Inc: NewYork, 1981.
3	Sinha, R, *Outlines of PolymerTechnology,* Prentice Hall of India: New Delhi, 2000.
4	Joel R. Fried, *Polymer Science and Technology*,3rd ed.;Prentice Hall of India: New Delhi, 2014.

Web Resources:
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 outcomes CO	On completion of this course, students will be able to:
CO1	Explain classification of polymers, elastomers, fibres and liquid resins.
CO2	Explain addition and condensation polymerization, mechanical and thermal properties of polymers.
CO3	Determine the molecular weight and crystallinity of polymers.
CO4	Explain reactions of polymers and polymer processing.
CO5	Discuss speciality polymers like PVC, PMMA, rubbers and biodegradable polymers.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Agro Chemistry

Title of the Course		Agro Chemistry					
Course Type		ELECTIVE - VIII					
Year	III	Semester	VI	Credits	3	Course Code	24UECH64
Instructional Hours Per week		Lecture	Tutorial		Lab Practice	Total	
		4	1		--	5	

Learning Objectives ; This course aims at providing knowledge on	
LO1	Fertilizers and manures.
LO2	Pesticides and their classifications.
LO3	The origin of soil.
LO4	Characterization of soil.
LO5	Testing of soil.

UNIT	CONTENTS
I	**<u>Fertilizers</u>** Classification, macronutrients -role of nitrogen, potassium and phosphorus on plant growth - manufacture of urea, muriate of potash and triple superphosphate. Complex fertilizers, mixed fertilizers & ***Bio fertilizers*** -their composition. Micro nutrients-their role in plants. ***Manures***: Bulky organic manures - Farm yard manure - oil cakes - blood meal - fish manures - Composting process - handling and storage.
II	**<u>Pesticides</u>** Definition - Classification of Pesticides based on the use and chemical composition - examples - general methods of application - Benefits of pesticides - Potential hazards. Safety measures-first aid Insecticides: Plant products - Nicotine, pyrethrin- Inorganic pesticides - borates. Organic pesticides-D.D.T. and BHC. Fungicide: Sulphur compounds, Copper compounds, Bordeaux mixture. Herbicides: Acaricides - Rodenticides. Attractants - Repellants.

III	**<u>Soil</u>** Origin of soil - definition of soil - rock system - weathering of rocks and minerals-main components of soil - organic, inorganic constituents - soil formation -factors favouring soil formation.
IV	**<u>Characteristics of soil</u>** Physical aspects - soil texture - pore space - bulk density, particle density - soil colour- surface area - soil colloids - plasticity, shrinkage - flocculation and deflocculation, soil air, soil temperature and their importance in plant growth. Acid, alkaline and saline soils - diagnosis - Methods of reclamation and after care.
V	**<u>Soil testing</u>** Concept and objectives - soil sampling, tools, collection, processing, and dispatch of soil sample. Estimation of total organic compound, available nitrogen and phosphorus in the soil sample. Determination of pH, EC, moisture content, bulk density and particle density of the soil sample

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 Transferrable Skill

Recommended Texts:	
1	A textbook of Soil Science - Daji.A, Asia Publishing House, Madras 1970.
2	Text book of soil Chemical Analysis-Hesse,P.R. A John Murray Newyork,1971
References Books:	
1	Textbook of Soil Science-Biswas, T.D and Mukherjee, S.K.Second edition, Tata McGraw-Hill Education
2	Chemistry for Agriculture and Ecology Y.Mido M. Satake, Discovery Publishing
3	Soil Fertility & Fertilisers - Samuel L. Tisdale, Werner L. Nelson, James D. Beaton, John L. Havlin. Fifth edition, Macmillan
4	Nature and properties of soils-Harry, O Buckman NY leC.Brandy, Macmillan
5	Insecticides, Pesticides and Agro based Industries - R.C. Paliwal, K. Goel, R.K. Gupta, Small Business Publications
Web Resources:	
	1. http://www.mcgill.ca- 2. http://naas.org.in

Course outcomes CO	On completion of this course, students will be able to:
CO1	Explain classification of fertilizers
CO2	Explain the classification of pesticides and insecticides
CO3	Determine the factors favouring soil formation
CO4	Explain the characteristic of soil
CO5	Explain the methods of testing of soil

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Applied Chemistry

Title of the Course		Applied Chemistry					
Course Type		Skill Enhancement Course - VI					
Year	III	Semester	VI	Credits	2	Course Code	24USCH61
Instructional Hours Per week		Lecture	Tutorial		Lab Practice	Total	
		2			--	2	

Learning Objectives ; This course aims at providing knowledge on

LO1	Gain knowledge on ores and alloys.
LO2	Study about industrially important compounds.
LO3	Acquire knowledge about basic needs of Agriculture developments.
LO4	Learn the substances useful for human life.
LO5	Study on Match and Silicate Industries.

Unit	Contents
I	**ORES AND ALLOYS** Iron ores – Indian iron resources – determination of ferrous iron and total iron by dichrometry and permanganometry-copper ores and brass-estimation of copper-silver ores and alloys- determination of silver-calcium carbonate minerals- amount of calcium in lime stone- Powder metallurgy: Production of metal powder-fabrication methods-advantages and applications of powder metallurgy.
II	**PAINTS, LUBRICANTS, ADHESIVES AND PIGMENTS** **Paints**: Classification- Primary constituents, Manufacturing of paints, Emulsion paint- Constituent and advantages-Latex paints and Fire retardant paints, Solvents and Thinners. **Lubricants**: Functions of lubricants-Properties and Classifications - Additives for lubricating oil, Lubricants of mineral origin. Lubricating grease and Solid lubricants. **Adhesives:** Classification and preparation of adhesives. Synthetic resin adhesives and Rubber based adhesives -Uses of adhesives. **Pigments**: Characteristics and uses of TiO_2, Ultramarine Blue and Red lead

III	**<u>AGRICULTURAL CHEMISTRY</u>** **Fertilizers**: Raw material, manufacture (flow chart)- Chemical process (with equation) of ammonium nitrate, ammonium sulphate, urea and ammonium phosphate fertilizers. **Pesticides**: Classification of pesticides, examples. **Insecticides**: Stomach poisons, Contact insecticides, Fumigants, Manufacture and uses of Insecticides: Aldrin and Pentachloro phenol. **Fungicides**: Lime sulphur and Creosote oil.
IV	**<u>OILS, SOAPS AND DETERGENTS</u>** **Oils**: Definition: Fats and Oils-Constituents-Sources-Difference between oils and fats, Manufacture of Cottonseed oil, Sunflower oil and Soya bean oil. **Soaps**: Definition, Manufacture of soaps- Types of soaps -Specific uses. **Detergents**: Difference between soaps and detergents, Synthetic detergents- Surface active agents and their classification- Anionic, Cationic and Non -ionic detergents - Applications including cleaning action.
V	**<u>MATCH AND SILICATE INDUSTRIES</u>** **Match Industry**; Types of Matches- Composition of match head and strikening surface- Manufacture of safety matches- Coloured matches- Pyro techniques and explosives, Classification of good explosives TNT, RDX, Gun powder, Ammonium nitrate. **Silicate industry**; Cement: Types of cements, composition, manufacture of Portland cement and Setting of cement. **Ceramics**: Introduction, Types, Manufacture, and Applications, Refractory materials. **Glass**: Definition, Composition, Types, Manufacturing of glass products, Physical and Chemical properties, Applications.

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 Transferrable Skill

Recommended Texts:	
1	B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut, 2003.
2	James A. Kent, Riegel's Handbook of Industrial Chemistry, Springer Science, 2013.
3	Introduction to material science by V. Raghavan, PHI learning Private ltd.
References Books:	
1	C.E. Dryden, Outlines Chemical Technology, Gopala Rao, East west Press, New Delhi
2	S. Johnson, N. Saikia, Fatty acids Profile of edible oils and fats in India, Centre for Science and Environment, New Delhi, India
3	Inorganic Chemistry by J.D. Lee.
Web Resources:	
	http://fazaia.edu.pk-Library

Course outcomes	On completion of this course, students will be able to:
CO1	Define ores and alloys.
CO2	Choose the suitable paints, pigments, lubricants and adhesives for day today life activities.
CO3	Analyse the highly useful fertilizers, pesticides, insecticides and fungicides to improve crop yield.
CO4	Discuss the oils, soaps and detergents which are necessary for health and other activities.
CO5	Outline the industrially important compounds for the human development activities.

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Forensic Science

Title of the Course		Forensic Science					
Course Type		Skill Enhancement Course - VI					
Year	III	Semester	VI	Credits	2	Course Code	24USCH62
Instructional Hours Per week		Lecture	Tutorial		Lab Practice	Total	
		2			--	2	

Learning Objectives ; This course aims at providing knowledge on

LO1	Gain knowledge on elementary forensic science
LO2	Study about poisons
LO3	Acquire knowledge about forgery and counterfeiting
LO4	Learn to know about crime detection
LO5	Study on Tracks and Traces

Unit	Contents
I	**Elementary forensic science** Definition of forensic science, The role of Forensic laboratory, Biometrics and personal identification. Introduction, concept of Biometric Authentication, Role in person identification- Face recognition, IRIS, Retina geometry, Hand geometry, Speaker Recognition, Signature Verification.
II	**Poisons** Poisons- types and classification- diagnosis of poison in the living and the dead - clinical symptoms-postmortem appearances. Heavy metal contamination (Hg, Pb and Cd) of seafoods- use of neutron activation analysis in detecting Arsenic in human hair. Treatment in cases of poisoning- use of antidotes for common poisons.
III	**Crime Deduction** Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs-possible explosives (gelatin sticks and RDX)-metal detector devices and other security measures for VVIP- composition of bullets and detecting power burns.

IV	**Forgery and Counterfeiting** Documents-different types of forged signatures- simulated and traced forgeries-inherent signs of forgery methods-Writing deliberately modified -uses of ultraviolet rays- comparison of type written letters-checking silver line watermark in currency notes- alloy analysis using AAS to detect counterfeit coins- detection of gold purity in 22 carat ornaments- deducting gold plated Jewels-authenticity of diamonds.
V	**Tracks and Traces** Tracks and traces -small tracks and Police dogs -of footprints, costing of footprints-residue prints, walking pattern or tyre marks- miscellaneous trace sand tracks-glass fracture- tool marks- paints- fibres- Analysis of biological substances- blood, semen, saliva, urine, and hair-Cranial analysis (head and teeth) DNA fingerprinting for tissue identification in dismembered bodies- detecting steroid conception in athletes and race horses.

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 Transferrable Skill

Recommended Texts:	
1	Anil K. Jain, Arun A. Ross and Karthik Nandakumar, *Introduction to Biometrics*, Springer, 2011.
2	David E. Newton, *Forensic Chemistry*, Fact on File, Inc, 2007.
3	Stuart H. James and Jon J. Nordby, *Forensic Science - An Introduction to Scientific and Investigative Techniques*, CRC Press, 2003.
4	Suzanne Bell, *Forensic Chemistry*, Pearson International, Second Edition, 2014.
References Books:	
1	Saferstein R, Criminalistics: An introduction to Forensic Science: Prentice Hall, Eaglewood cliffs, New Jersey, 2001.
2	Editor – G.R. Sinha, *Advances in Biometrics - Modern Methods and Implementation Strategies*, Springer, 2019.
3	Editor – Jay A. Siegel, *Forensic Chemistry -Fundamentals and applications*, Wiley-Blackwell, First edition, 2016**.**
4	Max M. Houck**,** *Forensic Science-Modern methods of solving crime*, Praeger Publishers, 2007.
5	Kelly M. Elkins, *Introduction to Forensic chemistry***,** CRC Press, 2019.
6	Matthew Johll, *Investigating Chemistry: A Forensic Science Perspective*, W.H. Freeman & Co, Second Edition, 2008

Course outcomes	**On completion of this course, students will be able to:**
CO1	Outline the elementary forensic chemistry
CO2	Discuss the classification of poisons and heavy metal contamination of seafoods.
CO3	Analyse the crime detection in accidental explosion, human bombs and metal detector devices
CO4	Discuss the forgery and counterfeiting
CO5	Knowledge about Tracks and traces

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	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

Blue Print – End Semester Examinations Semester - I to VI

Class: U.G. **Time: 3 Hours** **Max. Marks: 75**

Section A **(10 x 1 = 10)**

Answer all questions.
Choose the correct answer. (With four options)

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	1 & 2	3 & 4	5 & 6	7 & 8	9 & 10

Section B **(5 x 5 = 25)**

Answer all questions choosing either (a) or (b). Answer should not exceed 250 words

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	11 (a) & 11 (b)	12 (a) & 12 (b)	13 (a) & 13 (b)	14 (a) & 14 (b)	15 (a) & 15 (b)

Section C **(5 x 8 = 40)**

Answer all questions choosing either (a) or (b). Answer should not exceed 500 words

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	16 (a) & 16 (b)	17 (a) & 17 (b)	18 (a) & 18 (b)	19 (a) & 19 (b)	20 (a) & 20 (b)