HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)
Re-Accredited with A++ Grade by NAAC (3rd Cycle)
Uthamapalayam - 625 533.

DEPARTMENT OF CHEMISTRY

PART IV - CHEMISTRY

SYLLABUS

Choice Based Credit System – CBCS

(As per TANSCHE)

With

Outcome Based Education (OBE)

(Academic Year 2023 -2026)

Semester-I

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part – IV	23UCHSE11	Food Chemistry (NME)	2	25	75	100	2
	23UCHFN11	Role of Chemistry in daily life	2	25	75	100	2

Semester-II

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part – IV	23UCHSE21	Dairy Chemistry (NME)	2	25	75	100	2
	23UCHSE22	Cosmetics and Personal care Products	2	25	75	100	2

Semester-III

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part – IV	23UCHSE31	Entrepreneurial skills in Chemistry	1	25	75	100	1
	23UCHSE32	Pesticide Chemistry	2	25	75	100	2
	23UGEVS41	Environmental Studies	1	-	-	-	-

Semester-IV

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part – IV	23UCHSE41	Instrumental Methods of Chemical Analysis	2	25	75	100	2
	23UCHSE42	Forensic Science	2	25	75	100	2
	23UGEVS41	Environmental Studies	1	25	75	100	2

Semester-V

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part – IV	23UGVED51	Value Education	2	25	75	100	2
	23UCHIS51	Internship / Industrial Training	-	-	-	-	2

Semester-VI

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part – IV	23UCHSE61	Competitive Examination Skills in Chemistry	2	25	75	100	2

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UCHSE11	FOOD CHEMISTRY (NME)	NME	2	2	25	75	100

Learning Objectives		
L1	Types of food.	
L2	Food adulteration and poisons.	
L3	Food additives and preservation.	
UNIT	**Contents**	**No. of Hours**
I	**Food Adulteration** Sources of food, types, advantages and disadvantages. Food adulteration contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals - Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques.	6
II	**Food Poison** Food poisons-natural poisons (alkaloids-nephrotoxin)-pesticides, (DDT, BHC, Malathion)-Chemical poisons-First aid for poison consumed victims.	6
III	**Food Additives** Food additives-artificial sweeteners–Saccharin-Cyclomate and Aspartate, Food flavours-esters, aldehydes and heterocyclic compounds–Food colours- Emulsifying agents–preservatives-leavening agents. Baking powder– yeast–taste makers–MSG-vinegar.	6
IV	**Beverages** Beverages-soft drinks-soda-fruit juices-alcoholic beverages-examples. Carbonation-addiction to alcohol–diseases of liver and social problems.	6
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.	6
	Total	**30**

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
1	Learn about Food adulteration-contamination of Wheat, Rice, Milk and Butter.	K1,K2,K3,K4
2	Get an awareness about food poisons like natural poisons(alkaloids nephrotoxin) pesticides, DDT, BHC, Malathion.	K1,K2,K3,K4,K5,K6
3	Get an exposure on food additives, artificial sweeteners, Saccharin, Cyclomate and Aspartate in the food industries.	K1,K2,K3,K4,K5,K6

4	Acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.	K1,K2,K3,K4,K5,K6
5	Study about fats and oils-Sources of oils-production of refined vegetable oils-preservation. Saturated and unsaturated fats–MUFA and PUFA.	K1,K2,K3,K4,K5
Textbooks		
1.	***Food chemistry***, H.K. Chopra, P.S. Panesar, Narosa publishing house, 2010.	
2.	Jayashree Ghosh, ***Fundamental Concepts of Applied Chemistry***, S.Chand & Co.Publishers, second edition, 2006.	
3.	***Food chemistry***, H.K.Chopra, P.S.Panesar, Narosa publishning house, 2010.	
4.	***Food Chemistry***, Dr.L. Rakesh Sharma, Evince publishing, 2022.	
5.	***Food processing and preservation***, G. Subbulakshmi, Shobha A Udipi, Pdmini S Ghugre, New age International publishers, second edition,2021.	
Reference Books		
1.	H.-D. Belitz, Werner Grosch, ***Food Chemistry Springer Science & Business Media***, 4thEdition, 2009.	
2..	M. Swaminathan, ***Food Science and Experimental Foods***, Ganesh and 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.	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UCHFN11	ROLE OF CHEMISTRY IN DAILY LIFE	FC	2	2	25	75	100

Learning Objectives		
L1	Importance of Chemistry in everyday life.	
L2	Chemistry of building materials and food.	
L3	Chemistry of Drugs and pharmaceuticals.	
UNIT	**Contents**	**No. of Hours**
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	6
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.	6
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–toothpaste, face powder, soaps and detergents, shampoos, nail polish, perfumes –general formulation and preparations-possible hazards of cosmetic use.	6
IV	Chemicals in food production– fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate. Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses.	6
V	Pharmaceutical drugs-analgesics and antipyretics-paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives-classification and examples.	6
	Total	**30**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Earn about the chemicals used in everyday life as well as air pollution and water pollution.	K1,K2,K3,K4
2	Get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC bakelite, polyesters.	K1,K2,K3,K4, K5,K6
3	Acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats. Also have awareness about	K1,K2,K3,K4, K5,K6

	Cosmetics, Toothpastes, face powder, soaps and detergents.	
4	Discuss about the fertilizers like urea, NPK fertilizers and superphosphate. Fuel classification solid, liquid and gaseous; nuclear fuel- examples and uses.	K1,K2,K3,K4, K5,K6
5	Have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.	K1,K2,K3,K4, K5
Textbooks		
1.	***Food chemistry***, H.K.Chopra, P.S.Panesar, Narosa publishing house, 2010.	
2.	***A text book of pharmaceutical chemistry*** by Jayashree Ghosh, S Chand publishing, 2012.	
3.	S.Vaithyanathan, ***Text book of Ancillary Chemistry***; Priya Publications, Karur, 2006.	
4.	B.K, Sharma, ***Industrial Chemistry***; GOEL publishing house, Meerut, sixteenth edition, 2014.	
5.	Jayashree Ghosh, ***Fundamental Concepts of Applied Chemistry***, S.Chand & Co.Publishers, second edition, 2006.	
6.	***Introduction to forensic chemistry***, Kelly M. Elkins, CRC Press Taylor& Francis Group, 2019.	
Reference Books		
1.	Randolph. Norris Shreve, ***Chemical Process Industries***, Mc Graw Hill, Texas, fourth edition, 1977.	
2.	W.A. Poucher, Joseph A.Brink, Jr. ***Perfumes, Cosmetics and Soaps***, Springer, 2000.	
3.	A.K.De, ***Environmental Chemistry***, New Age International Public Co., 1990.	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UCHSE21	DAIRY CHEMISTRY (NME)	NME	2	2	25	75	100

Learning Objectives		
L1	chemistry of milk and milk products.	
L2	Processing of milk.	
L3	Preservation and formation of milk products.	
UNIT	**Contents**	**No. of Hours**
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.	6
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, Batchand HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.	6
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.	6
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.	6
V	**Fermented and other Milk Products** Fermented milk products – fermentation of milk-	6

	definition, conditions, cultured milk - definition of culture - example, conditions –cultured cream, butter milk - Bulgarious milk -acidophilous milk –Yoheer Indigeneous products- khoa and chhena definition - Ice cream -definition-percentage composition-types-ingredients-manufacture of ice–cream, stabilizers-emulsifiers and their role-milk powder-definition-need for making milk powder-drying process- types of drying.	
	Total	**30**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Understand about general composition of milk–constituents and its physical properties.	K1,K2,K3,K4
2	Acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batchand HTST Ultra High Temperature Pasteurization.	K1,K2,K3,K4,K5,K6
3	Learn about Cream and Butter their composition and how to estimate fat in cream and Ghee	K1,K2,K3,K4,K5,K6
4	Explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk	K1,K2,K3,K4,K5,K6
5	Have an idea about how to make milk powder and its drying process-types of drying process	K1,K2,K3,K4,K5
Text books		
1	K.Bagavathi Sundari, ***Applied Chemistry***, MJP Publishers, first edition, 2006.	
2	K.S.Rangappa and K.T.Acharya, ***Indian Dairy Products***, Asia Publishing House New Delhi, 1974.	
3	***Text book of dairy chemistry,*** M.P.Mathur, D.DattaRoy, P.Dinakar, Indian Council of Agricultural Research,1st edition,2008.	
4	***A Text book of dairy chemistry***, Saurav Singh, Daya Publishing house,1st edition, 2013.	
5	***Text book of dairy chemistry***, P. L. Choudhary ,Bio-Green book publishers, 2021	
Reference Books		
1.	Robert Jenness and S.Patom, ***Principles of Dairy Chemistry,*** S.Wiley, 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. Mc sweeney, ***Dairy Chemistry and Biochemistry***, Springer, Second edition, 2016.	
5	Dairy chemistry and biochemistry, P.F.Fox, T. Uniacke-Lowe, P.L.H.Mc Sweeney, J.A.O Mahony, Springer, Second edition, 2015.	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UCHSE22	COSMETICS AND PERSONAL CARE PRODUCTS	SEC	2	2	25	75	100

Learning Objectives		
L1	Formulations of various types of cosmetics and their significance.	
L2	Hair, skin and dental care.	
L3	Makeup preparations and personal grooming.	
UNIT	**Contents**	**No. of Hours**
I	**Skin care** Nutrition of the skin, skin care and cleansing of the skin; face powder–ingredients; creams and lotions – cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels–formulation and advantages; astringent and skin tonics – key ingredients, skin lightness, depilatories.	6
II	**Hair care** Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner types–ingredients. **Dental care** Toothpastes–ingredients–mouthwash.	6
III	**Makeup** Base–foundation–types–ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge.	6
IV	**Perfumes** Classification – Natural –plant origin–parts of the plant used chief constituents; animal origin– ambergris from whale, civetone from civet cat, musk from musk deer; synthetic–classification emphasizing characteristics–esters–alcohols–aldehydes–ketones.	6
V	**Beauty treatments** Facials - types – advantages – disadvantages; face masks–types; bleach-types–advantages–disadvantages; shaping the brows; eye lash tinting; perming types; hair colouring and dyeing ; permanent waving – hair straightening; wax types –waxing; pedicure, manicure- advantages – disadvantages.	6
	Total	**30**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Know about the composition of various cosmetic products.	K1,K2,K3,K4
2	Understand chemical aspects and applications of hair care and dental care and skin care products.	K1,K2,K3,K4,K5,K6
3	Understand chemical aspects and applications of perfumes	K1,K2,K3,K4,K5,K6

	and skin care products.	
4	To understand the methods of beauty treatments their advantages and disadvantage.	K1,K2,K3,K4,K5,K6
5	Understand the hazards of cosmetic products.	K1,K2,K3,K4,K5
Textbooks		
1.	Thankamma Jacob,(1997)***Foods, drugs and cosmetics*** –A consumer guide, Macmillan publication, London.	
Reference Books		
1.	Wilkinson JBE and Moore R J, (1997) ***Harry's cosmeticology***, 7thed., Chemical Publishers, London.	
2.	George Howard, (1987) ***Principles and practice of perfumes and cosmetics***, Stanley Therones, Chettenham.	
Web Resources		
1	http://www.khake.com/page75.html	
2	Net.foxsm/list/284	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UCHSE31	ENTREPRENEURIAL SKILLS IN CHEMISTRY	SEC	1	1	25	75	100

Learning Objectives		
L1	Develop entrepreneur skills in students.	
L2	Provide hands on experience to prepare and develop products.	
L3	Develop start-ups.	
UNIT	**Contents**	**No. of Hours**
I	**Food Chemistry** Food adulteration-contamination of food items with clay stones, water and toxic chemicals-Common adulterants.	3
II	Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast, MSG, vinegar.	3
III	Dyes-Classification–Natural, synthetic dyes and their characteristics–basic methods and principles of dyeing. Dyeing–cotton fabrics with natural and synthetic dyes, printing-tie and dye, batik.	3
IV	**Hands on Experience (Students can choose any four)** Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques. Preparation of Jam, squash and Jelly, Gulkand, cottage cheese.	3
V	Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, toothpaste/powder and disinfectants in small scale. Extraction of oils from spices and flowers. Testing of water samples using testing kit.	3
	Total	**15**

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
1	Identify adulterated food items by doing simple chemical tests.	K1,K2,K3,K4
2	Recognize about food additives and preservatives.	K1,K2,K3,K4, K5,K6
3	Classify natural and synthetic dyes.	K1,K2,K3,K4, K5,K6
4	Educate others about adulteration and motivate them to become entrepreneurs.	K1,K2,K3,K4, K5,K6
5	Prepare cleaning products and become entrepreneurs.	K1,K2,K3,K4, K5

Textbooks	
1.	George S & Muralidharan V,(2007) ***Fibre to Finished Fabric–A Simple Approach***, Publication Division, University of Madras,Chennai.
2.	Appaswamy GP, ***A Handbook on Printing and Dyeing of Textiles***.
Reference Books	
1.	Shyam Jha, ***Rapid detection of food adulterants and contaminants (Theory and Practice)***, Elsevier, eBook ISBN9087128004289, First Edition, 2015.
Web Resources	
1.	https://www.vlab.co.in/broad-area-chemical-sciences

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	3	2
CO 5	2	3	3	3	2	3	3	2	2	2

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UCHSE32	PESTICIDE CHEMISTRY	SEC	2	2	25	75	100

Learning Objectives		
L1	Gain knowledge about the various types of pesticides and their toxicity.	
L2	Understand the accumulation of pesticides in the form of residues and its analysis.	
L3	Gain knowledge on choice of alternate and eco-friendly pesticides.	
UNIT	**Contents**	**No. of Hours**
I	**Introduction**: History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties. Toxicity of pesticides**:** Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides.	6
II	**Insecticides:** Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, mode of action, uses, and toxicity. Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos and parathion-methyl. Organo chlorine–Endosulfan, heptachlor; Carbamate: Cartaphydrochloride, Methomyl, Propoxur.	6
III	**Pesticides residues:** Introduction-application of agrochemicals, dissemination pathways of pesticides, causes of pesticide residues, remedies. Pesticides residues in atmosphere-entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water –entry into water systems, action and effect in aquatic environment. Pesticides residues in soil. Entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility,decomposition and degradation by climatic factors and microorganism.	6
IV	**Pesticide Residues effect and analysis:** Effects of pesticides residue on human life, birds and animals-routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues-sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.	6
V	**Biopesticides:** Pheromones, attractants, repellents–Introduction, types and application (8-Dodecen-1-ol, 10-cis-12-hexadecadienoic acid, Trimed lure, Cue-lure, methyl eugenol, N, N-Diethyl-m-toluamide, Dimethyl phthalate,	6

	icaridin). Baits-Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.	
	Total	**30**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Teach about the pesticides and their toxicity with respect to structure and category.	K1,K2,K3,K4
2	Explain the preparation and property of insecticides.	K1,K2,K3,K4, K5,K6
3	Investigate the pesticide residues, prevention and care.	K1,K2,K3,K4, K5,K6
4	Demonstrate the extraction and analytical methods of pesticide residues	K1,K2,K3,K4, K5,K6
5	Make awareness to the public on bio-pesticides.	K1,K2,K3,K4, K5
Textbooks		
1.	Handa SK. ***Principles of pesticide Chemistry***. Agrobios (India); 2012.	
2.	Matolcsy G, Nádasy M, Andriska V. ***Pesticide Chemistry***. Elsevier; 1989.	
3.	J. Miyamoto and P. C. Kearney. **Pesticide Chemistry Human Welfare and the Environment** vol. IV ***Pesticide Residue and Formulation Chemistry***, Pergamon press, 1985.	
4.	R.Cremlyn: ***Pesticides***, John Wiley.	
Reference Books		
1.	Roy N.K., ***Chemistry of Pesticides***. CBS Publisher & Distributors Pvt Ltd; First Ed. (2010).	
2.	Nollet L.M., Rathore H.S., ***Handbook of pesticides: methods of pesticide residues analysis.*** CRC press; 2016.	
3.	Ellerbrock R.H., ***Pesticide Residues***	
Web Resources		
1.	https://funaab.edu.ng/funaab-ocw/opencourseware/Pesticide%20Chemistry.pdf	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UCHSE41	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS	SEC	2	2	25	75	100

Learning Objectives		
L1	Operation and trouble shooting of chemical instruments.	
L2	Fundamentals of analytical techniques and its applications in the characterization of compounds.	
L3	Theory of chromatographic separation and thermo/Electroanalytical techniques.	
L4	Stoichiometry and the related concentration terms.	
UNIT	**Contents**	**No. of Hours**
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.	6
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.	6
III	**UV-Visible and IR Spectroscopy** Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. **UV-Visible Spectrometry:** Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. **Infrared Spectroscopy:** Basic principles of instrumentation (choice of source, monochromator &detector) for single and double beam instrument; sampling techniques.	6
IV	**Thermal and Electro-analytical Methods of Analysis**	6

	TGA and DTA-Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate. DSC-Principle, Instrumentation and applications. Electroanalytical 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 and Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms and Rf value.	6
	Total	**30**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Explain preparation of solutions, stoichiometric calculations and to apply error analysis in the calibration and use of analytical instruments.	K1,K2,K3,K4
2	Explain theory, instrumentation and applications of flame photometry and Atomic Absorption spectrometry.	K1,K2,K3,K4,K5, K6
3	Explain theory, instrumentation and application of UV visible and infrared spectroscopy.	K1,K2,K3,K4,K5, K6
4	Discuss instrumentation, theory and applications of thermal and electrochemical techniques.	K1,K2,K3,K4,K5, K6
5	Explain the use of chromatographic techniques in the separation and identification of mixtures.	K1,K2,K3,K4,K5
Text books		
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, 6thIndian Reprint (2017).	
4.	R.Speyer, ***Thermal Analysis of Materials,*** CRC Press, 1993.	
5.	R.A. Day and A.L. Underwood, ***Quantitative Analysis***, 6thEd., Prentice Hall of India Private Ltd., New Delhi,1993.	
Reference Books		
1.	D. A. Skoog, D.M. West and F. J. Holler, ***Analytical Chemistry: An Introduction***, 5thedn., Saunders college publishing, Philadelphia, 1998.	
2.	Dash UN, ***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 Handbook of Chromatographic & Allied Methods***, Elles Harwood Ltd. London.
5.	G.H.Jeffery, J.Bassett, J.Mendham and R.C.Denney, ***Vogel's Textbook of Quantitative Chemical Analysis,*** sixth edition Pearson Education, 2000.
Web Resources	
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

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UCHSE42	FORENSIC SCIENCE	SEC	2	2	25	75	100

Learning Objectives		
L1	Crime detection through analytical instruments.	
L2	Forgery and its detection.	
L3	Medical aspects involved.	
UNIT	**Contents**	**No. of Hours**
I	**Poisons** Poisons-types and classification-diagnosis of poisons in the living and the dead-clinical symptoms-postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of sea foods-use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.	6
II	**Crime Detection** 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 powder burns.	6
III	**Forgery and Counter feiting** Documents-different types of forged signatures-simulated and traced forgeries-inherent signs of forgery methods-writing deliberately modified –uses of ultraviolet rays-comparison of type written letters–checking silver line water mark in currency notes–alloy analysis using AAS to detect counterfeit coins–detection of gold purity in 22 carat ornaments–detecting gold plated jewels-authenticity of diamond.	6
IV	**Tracks and Traces** Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints -residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.	6
V	**Medical Aspects** Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gaschromatography-Arson-naturalfiresandarson-burningcharacteristicsand chemistry of combustible materials -nature of combustion. Ballistics -	6

	classification-internalandterminalballistics-smallarms-laboratoryexamination of barrel washing and detection of powder residue by chemical tests.	
	Total	**30**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Learn about the Poisons-types and classification of poisons in the living and the dead organisms and also get information about Postmortem.	K1,K2,K3,K4
2	Get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices and other security measures for VVIP-composition of bullets and detecting powder burns.	K1,K2,K3,K4, K5,K6
3	Detect the forgery documents, different types of forged signatures.	K1,K2,K3,K4, K5,K6
4	Have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances-blood, semen, saliva, urine and hair-DNA Finger printing for tissue identification in dismembered bodies.	K1,K2,K3,K4, K5,K6
5	Get the awareness on Aids-causes and prevention and also have an exposure on handling fire explodes.	K1,K2,K3,K4, K5
Text books		
1.	S AIqbal, M Liviu, ***Textbook of forensic Chemistry***, Discovery publishing house private limited, 2011.	
2.	Kelly M.Elkins, ***Introduction to Forensic Chemistry,*** CRC Press, Taylor & Francis Group, 2019.	
3.	Javed I.Khan, Thomas J.Kennedy, Donnell R.Christian, Jr., ***Basic principles of Forensic chemistry***, Humana Press, first edition, 2012.	
4.	Bapuly AK, (2006) ***Forensic Science–i ts application in crime investigation***, Paras Medical Publisher, Hyderabad.	
5.	Sharma B.R., (2006) ***Scientific Criminal Investigation***, Universal Law Publishing Co. Pvt. Ltd, New Delhi.	
Reference Books		
1.	Richard Saferst, Sopfestein, ***Criminalistics-An Introduction to Forensic Science*** (College Version), Prentice Hall, Eighth edition, 2003.	
2.	Suzanne Bell, ***Forensic Chemistry***, Pearson, second international edition, 2014.	
3.	JaySiegel, ***Forensic chemistry: Fundamentals and applications***, Wiley-Blackwell, First edition, 2015.	
4.	Max M.Houck & JayA.Segal, (2006) ***Fundamentals of Forensic Science,*** Elsevier Academic press.	
5.	Henry C.Lee, Timothy Palmbach, Marilyn T.Miller, (2006) ***Henry Lee's Crime Scene Book,*** Elsevier Academic press.	
Web Resources		
1.	http://www.library.ucsb.edu/ist/03-spring/internet.html	
2.	http://www.wonderhowto.com/topic/forensic-science/	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UCHSE61	**COMPETITIVE EXAMINATION SKILLS IN CHEMISTRY**	**SEC**	**2**	**2**	**25**	**75**	**100**

Learning Objectives		
This course aims at providing knowledge on		
L1	Periodic properties and chemical bonding.	
L2	Chirality, geometrical isomerism and conformational analysis.	
L3	Substitution, Addition and Elimination reaction.	
L4	Point groups, Phase equilibrium, solid state and Chemical kinetics.	
L5	Structure determination of organic compounds by various spectroscopy**.**	
UNIT	**Contents**	**No. of Hours**
I	**Inorganic Chemistry** Periodic properties – Atomic radius – ionic radius, ionization potential, electron affinity and electronegativity – Their significance in chemical bonding. VB theory, MO theory – applications – Comparision of VB and MO theories – VSEPR theory – Bond order – Bond energy – Bond length Bond polarity - Hydrogen bond – Its influences.	6
II	**Organic Chemistry-I** Optical activity and concept of chirality – Different kinds of optically active compounds – configuration – Fischer, sawhorse and Newman projections – Absolute configuration R and S Notations – Methods with more than one chiral center – Asymmetric synthesis – optical purity. Geometrical isomerism resulting from double bonds – The E.Z. system of nomenclature – Geometrical isomerism of monocyclic compounds and fused ring systems – Conformational analysis – conformation and reactivity in acylic and cyclo – hexane systems.	6
III	**Organic Chemistry-II** Aliphatic nucleophilic substitution S_N1 and S_N2 reactions - Addition to double and triple bonds – Mechanism Hydration – Hydroboration – Hydroxiylation – epoxidation. Elimination reactions E_1 and E_2 Mechanism. Huckel's rule and concept of aromaticity – aromaticity of Benzenoid compounds – Carbohydrates: Glucose, fructose, Sucrose, Maltose, Starch, Cellulose.	6
IV	**Physical Chemistry** Symmetry elements and symmetry operations – Point groups - Phase equilibrium – Phase rule application of phase rule – one and two component systems.	6

	Chemical kinetics - Empirical rate laws and temperature dependence - complex reactions - steady state approximation - determination of reaction mechanisms - collision and theory – absolute reaction rate theory (ARRT). Unimolecular reactions - Enzyme catalysis – Michaelis Menton Law. Solid state: types of crystals – Crystal structures - Bragg's law and applications; Defects of solids.	
V	**Spectroscopy** Structure determination of organic compounds by IR, UV-Vis, ^{1}H & ^{13}C NMR and Mass spectroscopic techniques.	6
	Total	**30**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Teach about the competitive examination questions on hybridization and geometry of molecules	K1,K2,K3,K4
2	Explain competitive examination questions on Chirality, geometrical, optical and conformational isomerism.	K1,K2,K3,K4,K5,K6
3	Investigate competitive examination questions in substitution, addition and elimination reactions.	K1,K2,K3,K4,K5,K6
4	Demonstrate competitive examination questions from group theory, phase equilibrium, solid state and chemical kinetics.	K1,K2,K3,K4,K5,K6
5	Make awareness to competitive examination questions of structure determination of organic compounds by various spectroscopy	K1,K2,K3,K4,K5

Textbooks

1.	B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2010.
2.	M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.
3.	S.M. Mukherji and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.
4.	B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, 2001, 41st Edn.
5.	B. S. Bahl, G. D. Tuli and ArunBahl, Essentials of Physical Chemistry, S. Chand & Co. Ltd, New Delhi, 2011,
6.	Y.R. Sharma, Elementary Organic spectroscopy, S. Chand & company Ltd, New Delhi 1992.

Reference Books

1.	I. L. Finar, Organic Chemistry, Vol. (1& 2), England, WesleyLongman Ltd, 6th edition, 2006.
2.	Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, 6th edition, 2014.
3.	P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, 7th edition, 2002.
4.	Srivastava, A. K.; Jain, P. C. Chemical Analysis an Instrumental Approach, 3rd edition S. Chand, New Delhi, 1997.

Web Resources

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

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1