E.M.G. YADAVA WOMEN'S COLLEGE, MADURAI – 625 014.

(*An Autonomous Institution – Affiliated to Madurai Kamaraj University*)

Re-accredited (**3rd Cycle**) with Grade **A+** & **CGPA 3.51** by NAAC

DEPARTMENT OF CHEMISTRY

TANSCHE - **CBC**S With OBE

BACHELOR OF SCIENCE

PROGRAMME CODE - K

COURSE STRUCTURE

(w.e.f. 2023 – 2024 Batch onwards)

Annexure-15

E.M.G. YADAVA WOMENS COLLEGE, MADURAI -14.

(An Autonomous Institution – Affiliated to Madurai Kamaraj University)

(Re –accredited (3rd Cycle) with Grade A+ and CGPA 3.51 by NAAC)

TANSCHE-CBCS with OBE

DEPARTMENT OF CHEMISTRY–UG

COURSE STRUCTURE

(w.e.f. 2023 – 2024 Batch onwards)

Semester	Part	Course Code	Course Title	Teaching hrs (per week)	Duration of Exam (hrs.)	Marks Allotted			Credits
						CIA	SE	Total	
III	I	23OU1TA3/ 23OU1HN3	**Part I:** Tamil/Hindi	6	3	25	75	100	3
	II	23OU2EN3	**Part II:** General English -III	6	3	25	75	100	3
	III	23OUCH31	**Core Course 5**: General Chemistry-III	5	3	25	75	100	5
		23OUCH3P	**Core Course 6:** Qualitative Inorganic Analysis Practical	3	3	40	60	100	3
		23OUCHGEPH3	**GEC 3:** Allied Physics –I	4	3	25	75	100	3
		23OUCHGEPH3P	**GEC 4:** Allied Physics Practical -I	2	3	40	60	100	2
	IV	23OUCHSEC31	**SEC 4:** Entrepreneurial in Chemistry	1	3	25	75	100	1
		23OUCHSEC32	**SEC 5:** Pesticide Chemistry	2	3	25	75	100	2
			Environmental Studies	1	-	-	-	-	-
			Total	**30**					**22**
IV	I	23OU1TA4/ 23OU1HN4	**Part I:** Tamil/ Hindi	6	3	25	75	100	3
	II	23OU2EN4	**Part II:** General English - IV	6	3	25	75	100	3
	III	23OUCH41	**Core Course 7:** General Chemistry-IV	5	3	25	75	100	5
		23OUCH4P	**Core Course 8**: Physical Chemistry Practical – I	3	3	40	60	100	3
		23OUCHGEPH4	**GEC 5:** Allied Physics –II	3	3	25	75	100	3
		23OUCHGEPH4P	**GEC 6:** Allied Physics Practical –II	2	3	40	60	100	2
	IV	23OUCHSEC41	**SEC 6 :** Instrumental	2	3	25	75	100	2

			methods of chemical analysis						
		23OUCHSEC42	**SEC 7 :** Forensic Science	2	3	25	75	100	2
		23OU4EV4	Environmental Studies	1	3	25	75	100	2
			Total	**30**					**25**

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TANSCHE - CBCS with OBE

DEPARTMENT OF CHEMISTRY-UG

Generic Elective Course (For B.Sc., Physics)

COURSE STRUCTURE

(w.e.f. 2023 – 2024 Batch onwards)

Semester	Course Code	Course Title	Teaching hrs. (Per week)	Duration of Exam (hrs.)	Marks allotted			Credits
					CIA	SE	Total	
III	23OUPHGECH3	**GEC1:** Chemistry for Physical Sciences-I	4	3	25	75	100	3
	23OUPHGECH3P	**GEC2:** Chemistry Practical for Physical Sciences-I	2	3	40	60	100	2
IV	23OUPHGECH4	**GEC 3**: Chemistry for Physical Sciences-II	3	3	25	75	100	3
	23OUPHGECH4P	**GEC4 :** Chemistry Practical for Physical Sciences-II	2	3	40	60	100	2

Annexure-15

Department of Chemistry						Class: II B.Sc Che		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
III	Core Course 5	23OUCH31	General Chemistry -III	5	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓		

Course Objectives:

1. To study the physical properties of gases, liquids, solids and X-ray diffraction of solids.
2. To understand the fundamentals of nuclear chemistry and nuclear waste management
3. To provide the applications of nuclear energy
4. To understand the basic chemistry of halo-organic compounds, phenol and other aromatic alcohols
5. To the understand the preparations and properties of phenols and alcohols

Course Content:

UNIT– I: Gaseous state: Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell–Boltzmann distribution of speed of molecules- average, root mean square and most probable velocity and average kinetic energy. Collision frequency; collision diameter; mean free path and viscosity of gases. **Real gases:** Deviations from ideal gas behavior, (Andrew's and Amagat's plots); compressibility factor, Z-van der Waal's equation; Virial equation; Boyle temperature-critical phenomena – isotherms of CO_2- Continuity of state–Van der Waal's equation and the critical state; law of corresponding states- liquefaction of gases.

UNIT – II: Liquid and Solid State: Properties of Liquids- Surface tension, viscosity and their applications. Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Crystals – size and shape; laws of crystallography; symmetry elements – plane, centre and axis; Miller indices, unit cells and space lattices; 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 closepacking; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; comparison of structure and

properties of diamond and graphite-Defects in solids - stoichiometric and non-stoichiometric defects. **Liquid Crystals** – classification and applications.

Unit-III: Nuclear Chemistry: Natural radioactivity - α, β and y rays; half-life period; Fajan–Soddy group displacement law; Geiger–nuttall rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and $t^{1/2}$ and radioactive series. Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out) Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiationhazards, disposal of radioactive waste and safety measures.

Unit-IV: Halogen derivatives: aliphatic halogen derivatives: Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – SN^1, SN^2 and SN^i mechanisms with stereo chemical aspects and effect of solvent.

Di, Tri & Tetra Halogen derivatives: Nomenclature, classification, preparation, properties and applications. **Aromatic halogen compounds** Nomenclature, preparation, properties and uses-Mechanism of nucleophilic, aromatic substitution – benzyne intermediate.

Aryl alkyl halides: Nomenclature, benzyl chloride – preparation, properties and uses.

Unit-V: 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 tetraacetate. **Phenols:** Nomenclature; classification,- Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions – Fries, Claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction. Resorcinol, quinol, picric acid – preparation, properties and uses.

Aromatic alcohols: Nomenclature, benzyl alcohol – methods of preparation – hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation – substitution on the benzene nucleus, uses.

Thiols: Nomenclature, preparation and properties

Books for study:

1. Madan, R. D. and Sathya Prakash, (2003), "*Modern Inorganic Chemistry"*, 2nded; S. Chand and Company: New Delhi.
2. Puri. B.R., Sharma. L.R. and. Kalia, K.C (2009)," *Principles of Inorganic Chemistry*," Milestone Publishersand Distributors, New Delhi, thirtieth edition.
3. Puri, B. R. and Sharma, L. R. (2020), "*Principles of Physical Chemistry*", 46thed.; Vishal Publishing Company: Jalandhar.
4. Soni P.L and Mohan Katyal, (2006),"*Textbook of Inorganic Chemistry*," Sultan Chand & amp; Sons, twentieth edition,.
5. Jain, M. K Sharma, S. C. (2003),"*Modern Organic Chemistry*," Vishal Publishing, fourth reprint,.

Books for Reference:

1. Graham Solomons, T. W. (1992),"*Organic Chemistry*," John Wiley & Sons, fifth edition.
2. Carey Francis A. (2009)," *Organic Chemistry*," Tata McGraw-Hill Education Pvt., Ltd., New Delhi,seventh edition,
3. Finar L, (1996),"*Organic Chemistry*," Wesley Longman Ltd, England, sixth edition.
4. Soni, P. L and.Chawla, (2007)," *Text Book of Organic Chemistry,"* New Delhi, Sultan Chand & Sons,twenty ninth edition,
5. Lee, J.D (2005),"*Concise Inorganic Chemistry*," Blackwell Science, fifth edition,.

Web resources/E-books:

1. https://nptel.ac.in/courses/104104101
2.https://nptel.ac.in/courses/103106071
3.https://nptel.ac.in/courses/104106119s

Pedagogy:

Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill:

This course will enable the students to acquired knowledge about the gaseous state, liquid and solid state, nuclear chemistry, halogen derivatives and phenol.

Activities to be given:

1. Power point presentation on the structural mechanism of SN^1 and SN^2
2. To construct the structure and bonding of NaCl and CsCl using atomic model set.

COURSE LEARNING OUTCOMES (CLO's):

CLOs	Course Learning Outcomes Statements	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Explain the postulates and derivation from the kinetic gas equation; The Maxwell –Boltzmanndistribution of speed of molecules	K1 to K3
CLO2	Discuss the Surface tension, viscosity and their applications. Crystalline and amorphous.	K1 to K3
CLO3	Geiger–Nuttall rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism;radioactive decay series; magic numbers.	K1 to K4
CLO4	Evaluate the relationship Nomenclature and classes of alkyl halides – isomerism, physical properties,Chemical reactions	K1 to K3
CLO5	Construct Dow's process Raching process properties – acidic character and effect ofsubstitution on acidity.	K1 to K4

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Mapping of Course Learning Outcomes (CLO's) with Programme Outcomes (PO's)

CLO's	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	2	2	2	2
CLO2	3	2	2	2	3	2
CLO3	3	2	2	2	3	2
CLO4	3	2	2	3	3	2
CLO5	3	2	2	2	2	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

LESSON PLAN: TOTAL HOURS (75Hrs)

UNIT	DESCRIPTION	HOURS	MODE
I	**Gaseous state:** Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell–Boltzmann distribution of speed of molecules- average, root mean square and most probable velocity and average kinetic energy, law of equipartition of	15	Chalk and Talk, PPT, and quiz

	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, (Andrew's and Amagat's plots); compressibility factor, Z-van der Waal's equation; Virial equation; Boyle temperature; Numerical problems based on equations of states for real gases, isotherms of real gases – critical phenomena – isotherms of CO_2- Continuity of state– Van der Waal's equation and the critical state; law of corresponding states- liquefaction of gases.		
II	**Liquid and Solid State:** Properties of Liquids- Surface tension, viscosity and their applications. Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Crystals – size and shape; laws of crystallography; symmetry elements – plane, centre and axis; Miller indices, unit cells and space lattices; 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 closepacking; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; comparison of structure and properties of diamond and graphite-Defects in solids - stoichiometric and non-stoichiometric defects. **Liquid Crystals** – classification and applications.	**15**	Chalk and Talk, PPT, quiz and You tube Links
III	**Nuclear Chemistry:** Natural radioactivity - α, β and y rays; half-life period; Fajan–Soddy group displacement law; Geiger–nuttall rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and $t^{1/2}$ and radioactive series. Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out) Nuclear energy; nuclear fission and fusion – major nuclear reactors	**15**	Chalk and Talk, PPT, quiz, seminar and Virtual Labs

	in India; radiationhazards, 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_{N_1}, S_{N_2} and SNi mechanisms with stereo chemical aspects and effect of solvent. **Di, Tri & Tetra Halogen derivatives:** Nomenclature, classification, preparation, properties and applications. **Aromatic halogen compounds** Nomenclature, preparation, properties and uses Mechanism of nucleophilic, aromatic substitution – benzyne intermediate. **Aryl alkyl halides:** Nomenclature, benzyl chloride – preparation – preparation properties and uses	**15**	Chalk and Talk, PPT, quiz and group discussion
V	**Alcohols:** Nomenclature, classification, preparation, properties, use; conversions – ascent and descent ofseries; test for hydroxyl groups. Oxidation of diols by periodic acid and lead tetraacetate. **Phenols:** Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions – Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction. Resorcinol, quinol,picric acid – preparation, properties and uses. **Aromatic alcohols:**Nomenclature, benzyl alcohol – methods of preparation – hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation – substitution on the benzene nucleus, use.. **Thiols:** Nomenclature, structure, preparation and properties.	**15**	Chalk and Talk, PPT, quiz, Open book test
	Total Hours	**75**	

Course Designer: Mrs.K.Punitha

Annexure-15

Department of Chemistry						Class: II B.Sc chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
III	Core Course 6-Lab	23OUCH3P	Qualitative Inorganic Analysis	3	3	40	60	100

Course Objectives:

1. To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.

Course Content:

Qualitative Inorganic Analysis

1.Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphate, chloride, bromide, iodide, nitrate

2.Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite.

3.Elimination of interfering acid radicals and Identifying the group of basic radicals

4.Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium

5.Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)

Books for study:

1.Venkateswaran, V, Veeraswamy, R, Kulandivelu, A.R. (1997), "Basic *Principles of Practical Chemistry"* ,2nd ed.; Sultan Chand &Sons: New Delhi.

2. Nad, A. K., Mahapatra, B., Ghoshal, A. (2007), "*An advanced course in Practical Chemistry"*, 3rd ed.; New Central Book Agency: Kolkata.

Books for Reference:

1. Mendham, J, Denney, R. C, Barnes, J. D, Thomas, M, Sivasankar, B. (2000), "*Vogel's Textbook of Quantitative Chemical Analysis"*, 6th ed.; Pearson Education Ltd: New Delhi.

2. Ramanujam.V.V,(2008), "*Semimicro qualitative Analysis*," National Publishing House, Chennai.

Web Resource/E-Books:

1. http://www.iscnagpur.ac.in/study_material/dept_chemistry/4.1_MIS_and_NJS_Manual_for_Inorganic_semi-micro_qualitative_analysis.pdf

2. https://www.goodearthschool.org/admin/product_document/Chemistry---InorganicQualitative-analysis.pdf
3. http://www.rbmcollege.ac.in/sites/default/files/files/reading%20material/inorganicqualitative-analysis.pdf

Pedagogy: Chalk and Talk method, Power Point Presentations, Seminar, Group Discussion

LESSON PLAN: TOTAL HOURS (45 Hrs)

S.No	Description	Hrs	Mode
1	Instructions	5	Chalk and Talk
2	Analysis of Anions (Acid Radicals)	4	Demonstration
	Analysis of Cations (Basic Radicals)	4	Demonstration
3	Analysis of Anions	3	Chalk and Talk, Discussion, Procedure with illustration
4	Analysis of Cations	3	Chalk and Talk, Discussion, Procedure with illustration
5	Analysis of inorganic mixture -I	3	Discussion, Procedure with illustration
6	Analysis of inorganic mixture-II	3	Discussion, Procedure with illustration
7	Analysis of inorganic mixture -III	3	Discussion, Procedure with illustration
8	Analysis of inorganic mixture –IV	3	Discussion, Procedure with illustration
9	Analysis of inorganic mixture –V	3	Discussion, Procedure with illustration
10	Analysis of inorganic mixture –VI	3	Discussion, Procedure with illustration
11	Analysis of inorganic mixture –VII	3	Discussion, Procedure with illustration
12	Model	5	
	Total	45	

Course Designer: 1. Dr.(Mrs).S.Manimekalai

Annexure-15

EVALUATION (PRACTICAL)

Internal (Formative) : 40 marks

External (Summative) : 60 marks

Total :100 marks

Question Paper Pattern for Internal Practical Examination: 40 Marks

S.No	**Components**	**Marks**
1.	Acid Radicals	10
2	Basic Radicals	10
3.	Model Exam	10
4.	Viva	5
5	Observation Note	5
	Total	**40**

Question Paper Pattern for External Practical Examination: 60 Marks

S.No	**Components**	**Marks**
1.	Acid Radicals with procedure	20
2	Basic Radicals with procedure	20
3.	Viva	10
4.	Record Note	10
	Total	**60**

In respect of external examinations passing minimum is **35% for Under Graduate** Courses and in total, **aggregate of 40%.**

Latest amendments and revisions as per **UGC** and **TANSCHE** norm is taken into consideration to suit the changing trends in the curriculum.

Annexure-15

Department of Chemistry						Class: II B.Sc Chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
III	Skill Enhancement Course 4	23OUCHSEC31	Entrepreneurial in Chemistry	1	1	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✔		✓

Course Objectives:

1. To acquire knowledge on food chemistry
2. To study about dyes and its classification
2. To develop entrepreneur skills for the students
2. To provide hands on experience to prepare and develop the products
3. To develop start ups

Course Content:

Unit –I: Food Chemistry: Food Adulteration-contamination of food items with clay stones, water and toxic chemicals –commonadulterants. food additives, natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colourants, preservatives, leavening agents, baking powder and baking soda, Yeast, Msg,Vinegar.

Unit-II Dyes: Classification: Natural, synthetic dyes and their characteristics – basic method and principles of dyeing- Dyeing – Cotton Fabrics with Natural and Synthetic Dyes Printing – Tie and Dye, Batik.

Unit III: Hands On Experience: Detection of adulterants in food items like coffee, tea, pepper, Chilli powder, turmeric powder, butter,ghee, milk, honey etc., by simple techniques.

Unit IV: Hands On Experience: Preparation of Jam, Squash and Jelly, Gulkand, Cottage Cheese. Extraction of oils from spices and flowers. Testing of water samples using testing kit.

Unit V: Hands On Experience: Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, toothpaste/powder and disinfectants in small scale.

Books for study:

1. George S & Muralidharan V, (2007),"*Fibre to Finished Fabric – A Simple Approach, Publication Division,"* University of Madras, Chennai.
2. Appaswamy G P, "*A Handbook on Printing and Dyeing of Textiles,".*

Books for Reference:

1. *Shyam Jha,(2015), "Rapid detection of food adulterants and contaminants (Theory and Practice)", Elsevier, e- Book, ISBN 9087128004289, 1st Edition.*
2. Anitha Gautam and Neetu Singh (2022)," *Detect food adulteration with low cost methods*," Narendra Publishing House, Delhi.

Web resources/E-books:

1. https://www.brainkart.com/article/Functions-of-food_33938/

2.https://www.wqpmag.com/water-disinfection/uv-disinfection/article/10958170/uv-ozone-a-match- made-in-heaven

3. https://krishijagran.com/health-lifestyle/different-types-of-mushrooms/

4. https://www.mdpi.com/2076-3921/10/8/1264/htm

Pedagogy:

Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz.

Rationale for nature of Course:

Knowledge and Skill:

Students acquire knowledge on biological importance of food, water, soft drinks and familiarize in food nutritive values.

Entrepreneurship oriented:

This course will enable the students to develop their entrepreneurial skills that enable them to start small scale industry and become a successful entrepreneur.

Activities to be given:

To find out the adulterants present in food stuff using different chemicals.

Annexure-15

COURSE LEARNING OUTCOMES (CLO's):

CLOs	Course Learning Outcomes Statements	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Identify adulterated food items by doing simple chemical tests.	K1 to K3
CLO2	Understand concept of natural and synthetic dyes and its characteristics	K1 to K3
CLO3	Educate others about adulteration and motivate them to become entrepreneurs.	K1 to K3
CLO4	Prepare Jam, Squash and Jelly, Gulkand, Cottage Cheese.	K1 to K3
CLO5	prepare cleaning products and become entrepreneurs	K1 to K3

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	3	1	2	3	2
CLO2	3	3	2	3	3	2
CLO3	3	3	1	2	2	1
CLO4	3	2	2	1	1	2
CLO5	3	3	1	2	3	1

1-Basic Level 2- Intermediate Level 3- Advanced Level

LESSON PLAN: TOTAL HOURS (30 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
I	**Food Chemistry:** Food Adulteration-contamination of food items with clay stones, water and toxic chemicals – common adulterants. 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	Chalk and Talk, PPT, quiz,

II	**Dyes: Classification**: Natural, synthetic dyes and their characteristics – basic method and principles of dyeing-Dyeing – Cotton Fabrics with Natural and Synthetic Dyes Printing – Tie and Dye, Batik.	**3**	Chalk and Talk, PPT, quiz,
III	**Hands On Experience** Detection of adulterants in food items like coffee, tea, pepper, Chilli powder, turmeric powder, butter,ghee, milk, honey etc., by simple techniques.	**3**	Chalk and Talk, PPT, quiz,group discussion
IV	**Hands On Experience** Preparation of Jam, Squash and Jelly, Gulkand, Cottage Cheese. Extraction of oils from spices and flowers. Testing of water samples using testing kit.	**3**	Chalk and Talk, PPT, quiz,
V	**Hands On Experience** Preparation of Jam, Squash and Jelly, Gulkand, Cottage Cheese. Extraction of oils from spices and flowers. Testing of water samples using testing kit.	**3**	Chalk and Talk, PPT, quiz,
	Total	**15**	

Course Designers: 1. Dr.(Mrs).S.Manimekalai

2. Mrs.K.Punitha

Annexure-15

Department of Chemistry						Class: II B.Sc Chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
III	Skill Enhancement Course 5	23OUCHSEC32	Pesticide Chemistry(Discip line Specific)	2	2	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✔	✓	

Course Objectives:

1.To gain knowledge about the various types of pesticides and their toxicity.

2. To understand about various insecticides

3. To discuss about pesticides residues

4. To understand the accumulation of pesticides in in the form of residues and its analysis.

5. To acquired knowledge on choice of alternate and eco-friendly pesticides.

Course Content:

Unit 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.

Unit 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, toxicity.

Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.

Unit 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.

Unit 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.

Unit V Biopesticides: Pheromones, attractants, repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N-Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.

Books for study:

1. Handa S.K. (2012), "*Principles of Pesticide Chemistry*," Agrobios ,India.

2. Matolcsy G, Nádasy M, Andriska V. (1989) " *Pesticide Chemistry*," Elsevier;.

3.Miyamoto.J and Kearney.P.C, "*Pesticide Chemistry Human Welfare and the Environment*," vol. IV

Books for Reference:

1. Roy N. K., (2010),"*Chemistry of Pesticides*," CBS Publisher & Distributors P Ltd; 1st Ed.

2. Nollet L.M., Rathore H.S., (2016) "*Handbook of pesticides: methods of pesticide residues analysis*," CRC press;

3. Ellerbrock R.H., (2005)," *Pesticide Residues: Significance, Management and Analysis*,"

4. Cremlyn.R: "*Pesticides"*, John Wiley

Web resources/E-books:

1. https://www.brainkart.com/article/Functions-of-food_33938/

2.https://www.wqpmag.com/water-disinfection/uv-disinfection/article/10958170/uv-ozone-a-match- made-in-heaven

3. https://krishijagran.com/health-lifestyle/different-types-of-mushrooms/

4. https://www.mdpi.com/2076-3921/10/8/1264/htm

Pedagogy:

Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz.

Annexure-15

Rationale for nature of Course:

Knowledge and Skill:

Students acquire knowledge on insecticides and pesticides residues effect and analysis.

Employability Oriented: Take up employment in pesticides testing lab

Activities to be given:

To analyse the pesticides present in fruits and vegetables in laboratory.

COURSE LEARNING OUTCOMES (CLO's):

CLOs	Course Learning Outcomes Statements	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Analyse the pesticides and their toxicity with respect to structure and category.	K1 to K3
CLO2	Explain the preparation and property of pesticides	K1 to K3
CLO3	Investigate the pesticide residues, prevention and care	K1 to K3
CLO4	Demonstrate the extraction and analytical methods of pesticide residues	K1 to K3
CLO5	Make awareness to the public on bio-pesticides	K1 to K3

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	3	1	2	3	2
CLO2	3	3	2	2	2	2
CLO3	3	3	1	2	2	2
CLO4	3	2	2	1	1	2
CLO5	3	2	1	2	3	1

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-15

LESSON PLAN: TOTAL HOURS (30 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
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**	Chalk and Talk, PPT, quiz,
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, toxicity. Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.	**6**	Chalk and Talk, PPT, quiz,
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**	Chalk and Talk, PPT, quiz,group discussion
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**	Chalk and Talk, PPT, quiz,

V	**Biopesticides:** Pheromones, attractants, repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.	**6**	Chalk and Talk, PPT, quiz, Seminar, Assignment
	Total	**30**	

Course Designers: 1. Dr.(Mrs).S.Manimekalai

2. Mrs.K.Punitha

Annexure-15

Department of Chemistry						Class: II B.Sc Chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
IV	Core Course 7	23OUCH41	General Chemistry-IV	5	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✔		

Course Objectives:

1. To gain knowledge about thermodynamic concepts on chemical processes and applied aspects.
2. To acquire knowledge on thermochemical calculations
3. To understand the transition elements with reference to periodic properties and group study of transition metals.
4. To discuss the organic chemistry of ethers, aldehydes and ketones
5. To explain the organic chemistry of carboxylic acids

Course Content:

Unit – 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. Thermochemistry - Kirchhoff's equations -Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels. Zeroth law of thermodynamics -Absolute Temperature scale.

Unit – II Thermodynamics II: Limitations of first law- 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 van der Waals gas with changes in temperature, volume and pressure, entropy and probability of

disorderliness. 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-Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-applications Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements.

UNIT -III General Characteristics of d-block elements: Transition Elements- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc group metals.

Unit – IV Ethers, Thio ethers and Epoxides: Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$. Thioethers - nomenclature, structure, preparation, properties and uses. **Aldehydes and Ketones** Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein – Pondorf Verley reduction, reduction with $LiAlH_4$ and $NaBH_4$. Addition reactions of unsaturated carbonyl compounds: Michael addition.

Unit – V Carboxylic Acids: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Bouveault Blanc reduction, decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. **Carboxylic acid Derivatives:** Preparations of aliphatic and aromatic acid chlorides and amides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schottan- Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement. **Active methylene**

compounds: Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate**. Halogen substituted acids** – nomenclature; preparation by directhalogenation, iodination from unsaturated acids, alkyl malonic acids **Hydroxy acids** – nomenclature; preparation from halo, amino, aldehydicand ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on α, β and γ hydroxy acids.

Books for study:

1. Puri B.R., Sharma L.R, (1992) "*Principles of Physical Chemistry"*, ShobanLal Nagin Chand and Co., thirty three edition,
2. Kapoor, K. L (2009) "*A Textbook of Physical chemistry*," (volume-2 and 3), Macmillan, India Ltd, third edition.
3. Soni P.L., Mohan Katyal, (2006), "*Textbook of Inorganic Chemistry*," SultanChand & Sons, twentieth edition,
4. Jain, M. K., Sharma S. C (2003.),"*Modern Organic Chemistry*" Vishal Publishing, fourth reprint,
5. Mukherji, S.M., Singh, S.P (1994), "*Reaction Mechanism in OrganicChemistry"*, Macmillan India Ltd., third edition,

Books for Reference:

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

Web resources/E-books:

1. https://nptel.ac.in/courses/112102255
2. https://nptel.ac.in/courses/104101136

Pedagogy: Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz.

Annexure-15

Rationale for nature of Course:

Knowledge and Skill: This course to study and understand thermodynamics. To study the students may apply their skills and knowledge to d-block elements. To acquire knowledge on Ethers, Thio ethers and Epoxides and carboxylic acids.

Activities to be given:

To frame the structural mechanism of nucleophilic substitution reactions at the acyl carbon of acyl halide

COURSE LEARNING OUTCOMES (CLO's):

CLOs	Course Learning Outcomes Statements	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Explain the terms and processes in thermodynamics; discuss the various laws ofthermodynamics and thermo chemical calculations.	K1 to K3
CLO2	Discuss the second law of thermodynamics and its application to heat engine; discussthird law and its application on heat capacity measurement.	K1 to K3
CLO3	Investigate the chemistry of transition elements with respect to various periodicproperties and group wise discussions.	K1 to K4
CLO4	Discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compoundsincluding named organic reactions.	K1 to K3
CLO5	Discuss the chemistry and named reactions related to carboxylic acids and their derivatives; discuss chemistry of active methylene compounds, halogen substituted acidsand hydroxyl acids	K1 to K4

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	2	2	3	2
CLO2	3	2	3	2	3	2
CLO3	3	3	3	2	3	2
CLO4	3	2	2	3	3	2
CLO5	3	2	3	2	2	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-15

LESSON PLAN: TOTAL HOURS (75 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
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. Thermochemistry - Kirchhoff's equations -Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels. Zeroth law of thermodynamics -Absolute Temperature scale.	15	Chalk and Talk, PPT, quiz,
II	**Thermodynamics II:** Limitations of first law- 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 van der Waals gas with changes in temperature, volume and pressure, entropy and probability of disorderliness. 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-Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-applications Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements.	15	Chalk and Talk, PPT, quiz, group discussion
III	**General Characteristics of d-block elements** **Transition Elements**- Electronic configuration - General periodic trend variable valency, oxidation states, stability of	15	Chalk and Talk, PPT, quiz,

	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 group metals..		
IV	**Ethers, Thio ethers and Epoxides:** Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$. Thioethers - nomenclature, structure, preparation, properties and uses. **Aldehydes and Ketones** Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein – Pondorf Verley reduction, reduction with $LiAlH_4$ and $NaBH_4$. Addition reactions of unsaturated carbonyl compounds: Michael addition**.**	15	Chalk and Talk, PPT, quiz, seminar
V	**Carboxylic Acids**: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Bouveault Blanc reduction, decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. **Carboxylic acid Derivatives:** Preparations of aliphatic and aromatic acid chlorides and amides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schottan- Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann	15	Chalk and Talk, PPT, quiz Seminar,

	bromamide degradation and Curtius rearrangement. **Active methylene compounds:** Keto – enol tautomerism. Preparation andsynthetic applications of diethyl malonate and ethyl acetoacetate**. Halogen substituted acids** – nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids **Hydroxy acids** – nomenclature; preparation from halo, amino, aldehydicand ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on α, β and γ hydroxy acids.		
	Total	**75**	

Course Designer: Mrs.K.Punitha

Annexure-15

Department of Chemistry						Class: II B.Sc chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
IV	Core Course 8-Lab	23OUCH4P	Physical Chemistry practical – I	3	3	40	60	100

Course Objectives:

1.To understand the laboratory experiments in order to understand the concepts of physical changes in chemistry

2. To acquire knowledge on the rates of chemical reactions

3.To study colligative properties and adsorption isotherm

Course Content:

Unit – I Chemical kinetics

1.Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate).

2. Determination of order of reaction between iodide and persulphate(initial rate method).

3. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar

Thermochemistry

4. Determination of heat of neutralisation of a strong acid by a strongbase.

5. Determination of heat of hydration of copper sulphate.

Unit – II Electrochemistry – Conductance measurements

6. Determination of cell constant

7. Determination of molar conductance of strong electrolyte

8. Determination of dissociation constant of acetic acid

Colorimetry

9. Determination of concentration of copper sulphate solution

Unit –III

Colligative property

10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent

Adsorption

11. Construction of Freundlich isotherm for the adsorption of aceticacid on activated charcoal

Books for Reference:

1. Sindhu, P.S (2005).”*Practicals in Physical Chemistry”*, Macmillan India :New Delhi,
2. Khosla, B. D., Garg,V. C., Gulati, A. (2011); “*Senior Practical PhysicalChemistry,”* R.Chand : New Delhi,
3. Gupta, Renu, (2017.) “*Practical Physical Chemistry*,”1st Ed.; New AgeInternational: New Delhi,

Web resources / E-books:

1. https://www.vlab.co.in/broad-area-chemical-sciences
2. https://www.coursehero.com/file/19371215/EXPT-04-Heat-of-Neutralization-of-a-Strong-Acid-with-Strong-Base/

Pedagogy: Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz.

LESSON PLAN: TOTAL HOURS (45 Hrs)

S.No	Description	Hrs	Mode
1	Introduction	5	Chalk and Talk
2	Experiments	4	Demonstration
3	Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate).	3	Chalk and Talk, Discussion, Procedure with illustration
4	Determination of order of reaction between iodide and persulphate(initial rate method).	3	Chalk and Talk, Discussion, Procedure with illustration
5	Polarimetry: Determination of rate constant of acid catalysedinversion of cane sugar	3	Chalk and Talk, Discussion, Procedure with illustration
6	Determination of heat of neutralisation of a strong acid by a strongbase	3	Chalk and Talk, Discussion, Procedure with illustration
7	Determination of heat of hydration of copper sulphate.	3	Chalk and Talk, Discussion, Procedure with illustration

8	Determination of cell constant	3	Chalk and Talk, Discussion, Procedure with illustration
9	Determination of molar conductance of strong electrolyte	3	Chalk and Talk, Discussion, Procedure with illustration
10	Determination of dissociation constant of acetic acid	3	Chalk and Talk, Discussion, Procedure with illustration
11	Determination of concentration of copper sulphate solution	3	Chalk and Talk, Demonstration
12	Determination of molecular weight of an organic compound by Rastmethod using naphthalene or diphenyl as solvent.	3	Chalk and Talk, Demonstration
	Construction of Freundlich isotherm for the adsorption of aceticacid on activated charcoal.	3	Chalk and Talk, Demonstration
13	Model	3	
	Total	45	

Course Designers: 1.Dr.(Mrs).S.Manimekalai

2. Mrs.K.Punitha

Annexure-15

EVALUATION (PRACTICAL)

Internal (Formative) : 40 marks

External (Summative) : 60 marks

Total :100 marks

Question Paper Pattern for Internal Practical Examination: 40 Marks

S.No	Components	Marks
1.	Experiments	10
2	Calculation and graph for experiments	10
3.	Model Exam	10
4.	Viva	5
5.	Observation Note	5
	Total	**40**

Question Paper Pattern for External Practical Examination : 60 Marks

S.No	Components	Marks
1.	Experiments	20
2	Calculation and graph for experiments	15
3.	principle	5
4	Viva	10
5.	Record Note	10
	Total	**60**

In respect of external examinations passing minimum is **35% for Under Graduate** Courses and in total, **aggregate of 40%.**

Latest amendments and revisions as per **UGC** and **TANSCHE** norm is taken into consideration to suit the changing trends in the curriculum.

Annexure-15

Department of Chemistry						Class: II B.Sc Chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
IV	Skill Enhancement Course 6	23OUCHSEC41	Instrumental methods of chemical analysis	2	2	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✔	✓	

Course Objectives:

1. To gain knowledge on operation and troubleshooting of chemical instruments
2. To learn about fundamentals of analytical techniques and itsapplication in the characterization of compounds
3. To acquire knowledge on theory of chromatographic separation and
4. To understand the theory of thermo / electro analytical techniques
5. To study stoichiometry and the related concentration terms

Course Content:

Unit-1 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.

Unit –II Atomic Absorption Spectroscopy: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Unit – III UV-Visible and IR Spectroscopy: Origin of spectra, interaction of radiation with matter, fundamental lawsof spetroscopy and selection rules, validity of Beer-Lambert's law. **UV-Visible Spectrometry:** Basic principles, instrumentation (choice ofsource, monochromator and detector) for single and double beaminstrument; 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 beaminstrument; sampling techniques.

Unit – IV Thermal and Electro-analytical Methods of Analysis: TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate**.** DSC- Principle, Instrumentation and applications. .Electroanalytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry – principle.

Unit – V Separation and purification techniques: Classification, principle, Factors affecting - Solvent Extraction – Liquid- Liquid Extraction. Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents,Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms and Rf value.

Books for study:

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, (2007) "*Elements of Analytical Chemistry*," Sultan Chand, New Delhi,
3. Skoog, Holler and Crouch, (2017)." *Principles of Instrumental Analysis*," Cengage Learning, 6th Indian Reprint
4. R. Speyer, (1993.) "*Thermal Analysis of Materials*", CRC Press,
5. R.A. Day and A.L. (1993) "*Underwood, Quantitative Analysis*,"6thedn., Prentice Hall of India Private Ltd., New Delhi,

Books for Reference:

1. A. Skoog, D. M. West and F. J. Holler, (1998.) "*Analytical Chemistry: An Introduction,"* 5thedn., Saunders college publishing, Philadelphia,

2. Dash U N, (2011.) "*Analytical Chemistry; Theory and Practice*" Sultan Chand and sons Educational Publishers, New Delhi,
3. Christian, Gary D (2004) " *Analytical Chemistry*," 6th Ed., John Wiley & Sons, New York,
4. Mikes, O. &Chalmes, (2004) R.A." *Laboratory Handbook of Chromatographic & Allied Methods*," Elles Harwood Ltd. London
5. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, (2000) "*Vogel's Textbook of Quantitative Chemical Analysis*," sixth edition PearsonEducation,

Web resources/E-books:

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

Pedagogy: Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz.

Rationale for nature of Course:

Knowledge and Skill: To gain knowledge on instrumental methods of chemical Analysis.

Employability Oriented: Students will get employment in various industries

Activities to be given: To make an assignment on UV and IR spectroscopy.

COURSE LEARNING OUTCOMES (CLO's):

CLOs	Course Learning Outcomes Statements	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Apply error analysis in the calibration and use of analytical instruments, explain theory,instrumentation and application of flame photometry and Atomic Absorption spectrometry	K1 to K3
CLO2	Explain theory, instrumentation and application of UV visible and Infraredspectroscopy.	K1 to K3
CLO3	Able to discuss instrumentation, theory and applications of thermal and electrochemicaltechniques	K1 to K3
CLO4	Explain the use of chromatographic techniques in the separation and identification ofmixtures	K1 to K3
CLO5	Explain preparation of solutions, stoichiometric calculations	K1 to K3

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Annexure-15

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	3	1	2	3	2
CLO2	3	3	2	3	3	2
CLO3	3	3	1	2	2	1
CLO4	3	2	2	1	1	2
CLO5	3	3	1	2	3	1

1-Basic Level 2- Intermediate Level 3- Advanced Level

LESSON PLAN: TOTAL HOURS (30 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
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**	Chalk and Talk, PPT, quiz,
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**	Chalk and Talk, PPT, quiz,

III	**UV-Visible and IR Spectroscopy** Origin of spectra, interaction of radiation with matter, fundamental laws of spetroscopy and selection rules, validity of Beer-Lambert's law. **UV-Visible Spectrometry:** Basic principles, instrumentation (choice ofsource, monochromator and detector) for single and double beaminstrument; Basic principles of quantitative analysis: estimation of metalions from aqueous solution, geometrical isomers, keto-enol tautomers. **Infrared Spectroscopy:** Basic principles of instrumentation (choice ofsource, monochromator& detector) for single and double beaminstrument; sampling techniques.	**6**	Chalk and Talk, PPT, quiz, group discussion
IV	**Thermal and Electro-analytical Methods of Analysis** TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate DSC- Principle, Instrumentation and applications.Electroanalytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry – principle.	**6**	Chalk and Talk, PPT, quiz,
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	**6**	Chalk and Talk, PPT, quiz, Seminar,
	Total	**30**	

Course Designer: Mrs.K.Punitha

Annexure-15

Department of Chemistry						Class: II B.Sc Chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
IV	Skill Enhancement Course 7	23OUCHSEC42	Forensic Science (Discipline Specific)	2	2	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✔	✔	

Course Objectives:

1.To gain knowledge about poisons

2. To acquire knowledge on crime detection through analytical instruments

3. To understand about forgery and its detection

4. To outline the tracks and traces

5. To discuss on medical aspects involved

Course Content:

UNIT I Poisons : Types and classification - diagnosis of poisons in the living andthe dead - clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysisin detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.

Unit-II Crime Detection: Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Hum an bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns.

UNIT-III Forgery and 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 water mark in currency notes – alloy analysis using AAS todetect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.

UNIT-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.

UNIT-V Medical Aspects: Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas Chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.

Books for study:

1. Iqbal. S.A, Liviu.M. (2011.) "*Textbook of forensic chemistry*," Discovery publishing house private limited.
2. Kelly M. Elkins, (2019) "*Introduction to Forensic Chemistry*," CRC Press,Taylor & Francis Group.
3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr (2012.) "*Basicprinciples of Forensic chemistry*", Humana Press, first edition.
4. Bapuly AK, (2006) "*Forensic Science – Its application in crimeinvestigation*," Paras Medical Publisher, Hyderabad.
5. Sharma B.R., (2006) "*Scientific Criminal Investigation",* Universal Law Publishing Co. Pvt. Ltd, New Delhi.

Books for Reference:

1. Richard Saferst, (2003)," *In and Criminalistics- An Introduction to Forensic Science*" (College Version), Sopfestein, Printice hall, eighth edition.
2. Suzanne Bell, (2014.) *Forensic Chemistry, Pearson,"* second international edition.
3. Jay Siegel, (2015.) *Forensic chemistry: Fundamentals and applications*," Wiley-Blackwell, first edition.
4. Max M. Houck., Jay A. Segal, (2006) "*Fundamentals of ForensicScience*," Elsevier Academic press.
5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) " *HenryLee's Crime Scene"* Book Elsevier Academic press.

Web resources/E-books:

1. http://www.library.ucsb.edu/ist/03-spring/internet.html
2. http://www.wonder howto.com/topic/forensic-science/

Pedagogy: Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz.

Rationale for nature of Course:

Knowledge and Skill: To acquired knowledge on Forensic science.

Employment oriented:

This course will enable the students to get employment in Forensic lab

Activities to be given: Prepare power point presentation on crime detection

COURSE LEARNING OUTCOMES (CLO's):

CLOs	Course Learning Outcomes Statements	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	learn about the Poisons - types and classification of poisons in the living and the deadorganisms and also get information about Postmortem.	K1 to K3
CLO2	get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices and other security measures for VVIP - composition of bulletsand detecting powder burns	K1 to K3
CLO3	detect the forgery documents, different types of forged signatures	K1 to K3
CLO4	have an idea about how to tracks and trace using police dogs, foot prints identificationand gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies.	K1 to K3
CLO5	get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.	K1 to K3

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Annexure-15

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

LESSON PLAN: TOTAL HOURS (30 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
I	**Poisons** Poisons - types and classification - diagnosis of poisons in the living andthe dead -clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, 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.	**6**	Chalk and Talk, PPT, quiz,
II	**Crime Detection** Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Hum an bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns.	**6**	Chalk and Talk, PPT, quiz,
III	**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 water mark in currency notes – alloy analysis using AAS todetect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.	**6**	Chalk and Talk, PPT, quiz, group discussion
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,	**6**	Chalk and Talk, PPT, quiz,

	urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.		
V	**Medical Aspects** Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials - nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.	**6**	Chalk and Talk, PPT, quiz, Seminar,
	Total	**30**	

Course Designers: 1.Mrs.K.Punitha

2. Dr.(Mrs) S.Manimekalai

Annexure-15

Department of Chemistry					Class: II B.Sc Physics			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
III	Generic Elective Course 3	23OUCHGEPH3	Chemistry for physical sciences -I	3	4	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship Oriented
✓		

Course Objectives:

1. To learn basics of atomic orbitals, chemical bonds, hybridization
2. To understand the importance of chemical industries
3. To gain knowledge on fundamental concept of organic chemistry
4. To study concepts of thermodynamics and its applications.
5. To gain knowledge on qualitative and analytical methods.

Course Content:

Unit - I Chemical Bonding and Nuclear Chemistry: Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. **Nuclear Chemistry**: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion- differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.

Unit - 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). Silicones**:** Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.

Unit III– Fundamental Concepts in Organic Chemistry: Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric, mesomeric, hyper

conjugation and steric- examples. Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel- Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

Unit - IV Thermodynamics and Phase Equilibria: Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. Phase Equilibria**:** Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).

Unit -V Analytical Chemistry: Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.

Books for Study:

1. Veeraiyan.V., (2009), "*Ancillary Chemistry*" High mountpublishing house, Chennai, first edition.
2. Vaithyanathan.S., (2006), "*Ancillary Chemistry*" PriyaPublications, Karur.
3. ArunBahl.S., Bahl.B.S., (2012), "*Advanced Organic Chemistry*" S.Chand and Company, NewDelhi, twenty third edition.
4. Soni.P.L., ChawlaH.M., (2007), *"Organic Chemistry*;"Sultan Chand & sons, New Delhi, twenty ninthedition.

Books for Reference:

1. Soni,MohanKatyal.P.L., (2007), "I*norganicchemistry*" SultanChan dandCompany,New Delhi, twentieth edition.
2. Puri.B.R., Sharma.L.R.., Pathania.M.S., (2018), "*PhysicalChemistry*" Vishal Publishing Co. New Delhi, forty seventh edition.
3. Sharma.B.K.(2014),"*IndustrialChemistry*" GOELpublishinghouse,Meerut,sixteenthedition.

Web Resources/e-books:

1. https://byjus.com/jee/chemical-bonding/
2. https://www.vedantu.com/question-answer/write-the-formula-of-water-gas-and-producer-gas-class-12-chemistry-cbse-602b4022a6d07335c46fc5e8
3. http://www.adichemistry.com/general/chemicalbond/vbt/hybridization-illustrations.html
4. https://phys.libretexts.org/Bookshelves/College_Physics/College_Physics_1e_(OpenStax)/15%3A_Thermodynamics/15.01%3A_The_First_Law_of_Thermodynamics
5. https://byjus.com/chemistry/analytical-chemistry/

Pedagogy:

Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz through ICT-Mode

Rationale for nature of Course:

Knowledge and Skill:

This course will enable the students to gain knowledge about chemical bonding, hybridization, industrial chemistry, thermodynamics and analytical chemistry.

Activities to be given:

To find out the composition of natural gas and water gas

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Gain in-depth knowledge about the theories of chemical bonding, nuclear reactionsand its applications.	K1 to K3
CLO 2	Evaluate the efficiencies and uses of various fuels and fertilizers	K1 to K3
CLO 3	Explain the type of hybridization, electronic effect and mechanism involved in theorganic reactions.	K1 to K4
CLO 4	Apply various thermodynamic principles, systems and phase rule.	K1 to K3
CLO 5	Explain various methods to identify an appropriate method for the separation ofchemical components	K1 to K4

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Annexure-15

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	2	1	2	1
CLO2	3	2	2	1	2	1
CLO3	3	2	2	2	2	2
CLO4	3	2	2	2	2	2
CLO5	3	2	2	2	2	2

1-Basic Level 2- Intermediate Level 3- Advanced Level

LESSON PLAN: TOTAL HOURS (60 Hrs)

Unit	Description	Hours	Mode
I	Chemical Bonding**:** Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen Helium, Nitrogen; discussion of bond order and magnetic properties.		Chalk and Talk, PPT
	Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.	12	Chalk and Talk, PPT
II	Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones**:** Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.	12	Chalk and Talk, PPT
III	Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples. Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel- Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.	12	Chalk and Talk, PPT

IV	Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. Phase Equilibria**:** Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).	12	Chalk and Talk, PPT, group discussion
V	Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.	12	Chalk and Talk, PPT
	Total Hours	60	

Course Designer: 1. Mrs.K.Punitha

Annexure-15

Department of Chemistry						Class: II B.Sc physics		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
III	Generic Elective Course 4-Lab	23OUCHGEPH3P	Chemistry Practical for Physical Sciences- I	2	2	40	60	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✔	

Course Objectives:

1. To provide knowledge on the basics of preparation of solutions.
2. To provide knowledge on principles and practical experience of volumetric analysis

Volumetric Analysis:

1. Estimation of sodium hydroxide using standard sodiumcarbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of oxalic acid using standard ferrous sulphate.
4. Estimation of ferrous sulphate using standard Mohr's salt.
5. Estimation of ferrous ion using diphenyl amine as indicator.
6. Estimation of potassium permanganate using standardsodium hydroxide.
7. Estimation of magnesium using EDTA.

Books for Reference:

1. Venkateswaran.V, Veeraswamy.R, Kulandaivelu.A.R., (2012*),"Basic Principles of Practical Chemistry",* 2nd Edition, Sultan Chand & Sons, New Delhi
2. Mendham J., Denney R. C., Barnes J. D., Thomas M., Sivasankar B., (2000)"*Vogel's Textbook of Quantitative Chemical Analysis*," 6th edn, Pearson Education Ltd., New Delhi.
3. Mukhopadhyay R., Chatterjee P., (2007), "*Advanced Practical Chemistry*," 3rd Edition, Books and Allied Pvt., Kolkata.

Web resources/E-books:

1. **http://allcomputerprograms.blogspot.com/2011/09/estimation-of-ferrous-iron-redox.html**
2. **https://byjus.com/chemistry/titration-of-oxalic-acid-with-kmno4/**
3. **https://byjus.com/chemistry/titration-of-hydrochloric-acid-against-standard-sodium-carbonate/**
4. **https://byjus.com/jee/hardness-of-water-types-and-removal/**

Pedagogy: Chalk and Talk, Group Discussion, Data interpretation and Demonstration

LESSON PLAN: TOTAL HOURS (30 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
1	Instructions	5	Chalk and Talk, Group discussion
2	Estimation of sodium hydroxide using standard sodiumcarbonate.	3	Discussion, Data interpretation
3	Estimation of hydrochloric acid using standard oxalic acid.	3	Discussion, Data interpretation
4	Estimation of oxalic acid using standard ferrous sulphate.	3	Discussion, Data interpretation
5	Estimation of ferrous sulphate using standard Mohr's salt	3	Demonstration, Data interpretation
6	Estimation of ferrous ion using diphenyl amine as indicator	3	Demonstration, Data interpretation
7	Estimation of potassium permanganate using standardsodium hydroxide.	3	Demonstration, Data interpretation
8.	Estimation of magnesium using EDTA.	3	Discussion, Data interpretation
9	Model	4	
	Total	30	

Course Designer: Mrs.K.Punitha

Annexure-15

EVALUATION (PRACTICAL)

Internal (Formative) : 40 marks

External (Summative) : 60 marks

Total :100 marks

Question Paper Pattern for Internal Practical Examination: 40 Marks

S.No	Components	Marks
1.	Experiments	10
2	Procedure	10
3.	Model Exam	10
4.	Viva	5
5.	Observation note	5
	Total	**40**

Question Paper Pattern for External Practical Examination (Major): 60 Marks

S.No	Components	Marks
1.	Experiments	30
2	Procedure	10
3.	Viva	10
4.	Record note	10
	Total	**60**

Distribution of marks for External

Estimation (30 marks)

Error <2% - 30 marks

Error 2-3% -25 marks

Error 3-4% -20 marks

Error >4% -10 marks

In respect of external examinations passing minimum is **35% for Under Graduate** Courses and in total, **aggregate of 40%.**

Latest amendments and revisions as per **UGC** and **TANSCHE** norm is taken into consideration to suit the changing trends in the curriculum.

Annexure-15

Department of Chemistry					Class: II B.Sc Physics			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
IV	Generic Elective Course 4	23OUCHGEPH4	Chemistry for physical sciences -II	3	3	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship Oriented
✓		

Course Objectives:

1. To gain knowledge on co-ordination chemistry and water technology
2. To understand about Carbohydrates and Amino acids
3. To acquire basics and applications of electrochemistry
4. To basics and applications of kinetics and catalysis
5. To study about Various photochemical phenomenon

Course Content:

Unit - I Co-ordination Chemistry and Water Technology: Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$,$[Co(CN)_6]^{3-}$ Chelation -Biological role of Haemoglobin 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 and COD.

Unit - 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. RNA and DNA (elementary idea only).

Unit – III Electrochemistry: Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials-electrochemical series. Strong and weak electrolytes - ionic product

of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.

Unit - IV Kinetics and Catalysis: Order and molecularity. Integrated rate expression for I and II (2A→Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Catalysis- homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.

Unit -V Photochemistry: Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

Books for Study:

1. Veeraiyan.V., (2009), "*Ancillary Chemistry*" High mountpublishing house, Chennai, first edition.
2. Vaithyanathan.S., (2006), "*Ancillary Chemistry*" Priya Publications, Karur.
3. ArunBahl.S., Bahl.B.S., (2012), "*Advanced Organic Chemistry*" S.Chand and Company, New Delhi, twenty third edition.
4. Soni.P.L., Chawla. H.M., (2007), "*Organic Chemistry*;" Sultan Chand & sons, New Delhi, twenty ninth edition.

Books for Reference:

1. Soni, Mohan Katyal.P.L., (2007), "*Inorganic chemistry"* Sultan Chand and Company, New Delhi, twentieth edition.
2. Puri.B.R., Sharma.L.R., Pathania.M.S., (2018), "*PhysicalChemistry*" ishal Publishing Co, New Delhi, forty seventh edition.
3. Sharma.B.K., (2014), "*IndustrialChemistry"* GOELpublishinghouse,Meerut,sixteenthedition.

Web Resources/e-books:

1. https://cdn1.byjus.com/wp-content/uploads/2019/07/Tamil-Nadu-State-Board-Textbooks_Samacheer-Kalvi-Class-XII_Chemistry_Vol-1_Unit-5_English_Medium.pdf
2. https://www.sathyabama.ac.in/sites/default/files/course-material/2020-10/note_1456404597.pdf

3. https://soe.unipune.ac.in/studymaterial/swapnaGaikwadOnline/aminoacids-171113130407.pdf
4. https://chem.pg.edu.pl/documents/175289/4235721/Electrochemistry-supplement%20text.pdf
5. https://gcwgandhinagar.com/econtent/document/1587113971photochemistry.pdf

Pedagogy:

Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz through ICT-Mode

Rationale for nature of Course:

Knowledge and Skill: This course will enable the students to acquired knowledge on Co-ordination Chemistry and Water Technology, Carbohydrates, Amino Acids and kinetics and catalysis, electro chemistry and photochemistry

Activities to be given: To calculate EAN rule of $[Ni(CN)_4]^{2-}$,$[Co(CN)_6]^{3-}$ complexes.

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Write the IUPAC name for complex, different theories to explain the bonding incoordination compounds and water technology	K1 to K3
CLO 2	Explain the preparation and property of carbohydrate, amino acids and nucleic acids.	K1 to K3
CLO 3	Apply demonstrate the electrochemistry principles in corrosion, electroplating and fuelcells.	K1 to K4
CLO 4	Identify the reaction rate, order for chemical reaction and explain the purpose of acatalyst.	K1 to K3
CLO 5	Outline the various type of photochemical process.	K1 to K4

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Annexure-15

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	3	3	3	3
CLO2	3	3	3	3	3	3
CLO3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3
CLO5	3	3	3	3	3	3

1-Basic Level **2- Intermediate Level** **3- Advanced Level**

LESSON PLAN: TOTAL HOURS (60 Hrs)

Unit	Description	Hours	Mode
I	Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)4]$, $[Ni(CN)4]^{2-}$,$[Co(CN)6]^{3-}$ Chelation - Biological role of Haemoglobin 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.	9	Chalk and Talk, PPT
II	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. RNA and DNA (elementary idea only).	9	Chalk and Talk, PPT
III	Electrochemistry:Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials-electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.	9	Chalk and Talk, PPT
IV	Kinetics and Catalysis : Order and molecularity. Integrated rate expression for I and II (2A → Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period. Catalysis- homogeneous and heterogeneous,	9	Chalk and Talk, PPT, group discussion

	catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.		
V	Photochemistry: Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).	9	Chalk and Talk, PPT
	Total Hours	45	

Course Designer: 1. Mrs.K.Punitha

Annexure-15

Department of Chemistry						Class: II B.Sc (Physics)		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
IV	Generic Elective Course 5-Lab	23OUCHGEPH4P	Chemistry Practical for Physical Sciences -II	2	2	40	60	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

Course Objectives:

1. To provide knowledge on identification of organic functional groups
2. To provide knowledge on different types of organic compounds with respect to their properties.
3. To gain knowledge on determination of elements in organic compounds

SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS

The analysis must be carried out as follows:

1. Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehydeand glucose].
2. Detection of elements (N, S, Halogens).
3. To distinguish between aliphatic and aromaticcompounds
4. To distinguish – Saturated and unsaturated compounds

Books for Reference:

1. Venkateswaran.V, Veeraswamy.R, Kulandaivelu.A.R, (2012*), "Basic Principles of Practical Chemistry",* 2nd Edition, Sultan Chand & Sons, New Delhi.
2. Mendham J., Denney R. C., Barnes J. D., Thomas M., Sivasankar B., (2000)"*Vogel's Textbook of Quantitative Chemical Analysis*," 6th edn, Pearson Education Ltd., New Delhi.
3. Mukhopadhyay R., Chatterjee P., (2007) "*Advanced Practical Chemistry*," 3rd Edition, Books and Allied Pvt., Kolkata,

Web resources/E-books:

1. **http://allcomputerprograms.blogspot.com/2011/09/estimation-of-ferrous-iron-redox.html**
2. **https://byjus.com/chemistry/titration-of-oxalic-acid-with-kmno4/**
3. **https://byjus.com/chemistry/titration-of-hydrochloric-acid-against-standard-sodium-carbonate/**
4. **https://byjus.com/jee/hardness-of-water-types-and-removal/**

Pedagogy: Chalk and Talk, Group Discussion, Data interpretation and Demonstration

LESSON PLAN: TOTAL HOURS (30 Hrs)

S.No	Description	Hrs	Mode
1	Instructions	4	Chalk and Talk
2	Detection of special elements, Aromatic and aliphatic nature, Test for saturation and unsaturation	4	Demonstration
3	Identification of functional groups	4	Demonstration
4	Derivative preparation	2	Demonstration
5	Analysis of organic substance -I	2	Discussion, Procedure with illustration
6	Analysis of organic substance -II	2	Discussion, Procedure with illustration
7	Analysis of organic substance -III	2	Discussion, Procedure with illustration
8	Analysis of organic substance –IV	2	Discussion, Procedure with illustration
9	Analysis of organic substance -V	2	Discussion, Procedure with illustration
10	Analysis of organic substance -VI	2	Discussion, Procedure with illustration
11	Model	4	
	Total	30	

Course Designer: 1. Mrs.K.Punitha

Annexure-15

EVALUATION (PRACTICAL)

Internal (Formative) : 40 marks

External (Summative) : 60 marks

Total :100 marks

Question Paper Pattern for Internal Practical Examination: 40 Marks

S.No	**Components**	**Marks**
1.	Experiment-Organic Analysis	10
2	Procedure for organic analysis	10
3.	Model Exam	10
4.	Viva	5
5.	Observation Note	5
	Total	**40**

Question Paper Pattern for External Practical Examination: 60 Marks

S.No	**Components**	**Marks**
1.	Experiment- Organic Analysis	30
2	Procedure for organic analysis	10
3.	Viva	10
4.	Record Note	10
	Total	**60**

In respect of external examinations passing minimum is **35% for Under Graduate** Courses and in total, **aggregate of 40%.**

Latest amendments and revisions as per **UGC** and **TANSCHE** norm is taken into consideration to suit the changing trends in the curriculum.