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

CBCS With OBE

BACHELOR OF SCIENCE

PROGRAMME CODE - K

COURSE STRUCTURE

(w.e.f. 2022 – 2023 Batch onwards)

Annexure-13

E.M.G. YADAVA WOMEN'S COLLEGE, MADURAI -14.

(An Autonomous Institution – Affiliated to Madurai Kamaraj University)
(Re –accredited (3rd cycle) with Grade A+ and CGPA 3.51 by NAAC)

DEPARTMENT OF CHEMISTRY – UG CBCS with OBE

(With Allied Mathematics and Allied Physics)

COURSE STRUCTURE

(w.e.f. 2022 – 2023 Batch onwards)

Semester	Part	Course Code	Title of the Course	(Teaching Hours per week)	(Duration of Exam Hours)	Marks Allotted			Credits
						CIA	SE	Total	
I	I	**22OU1TA1**	**Part I:** Tamil	6	3	25	75	100	3
	II	**22OU2EN1**	**Part II:** English	6	3	25	75	100	3
	III	**22OUCH11**	**Core**: General Chemistry-I	4	3	25	75	100	4
	III		**Core** : Practical – I Semi Micro Inorganic Qualitative Analysis	2	-	-	-	-	-
	III	**22OUCHGEMA1**	**GEC**: Mathematics –I Theory of equations, Trigonometry, Analytical Geometry 3D and Vector Calculus	6	3	25	75	100	4
	IV	**22OUCHSE11**	**SEC**: Good Laboratory Practices	2	3	25	75	100	2
	IV	**22OUCHSE12**	**SEC**: Pharmaceutical Chemistry	2	3	25	75	100	2
	IV	**22OUCHID1**	**IDC**: Chemistry in Everyday Life	2	3	25	75	100	2
II	I	**22OU1TA2**	**Part I:** Tamil	6	3	25	75	100	3
	II	**22OU2EN2**	**Part II:** English	6	3	25	75	100	3

	III	**22OUCH21**	**Core**: General Chemistry-II	4	3	25	75	100	4
	III	**22OUCH2P**	**Core**: Practical – I Semi Micro Inorganic Qualitative Analysis	2	3	40	60	100	2
	III	**22OUCHGEMA2**	**GEC**: Mathematics– II Calculus, Differential Equations and Applications	6	3	25	75	100	5
	IV	**22OUCHSE21**	**SEC**: Industrial Chemistry	2	3	25	75	100	2
	IV	**22OUCHSE22**	**SEC**: Analytical Clinical Biochemistry	2	3	25	75	100	2
	IV	**22OUCHID2**	**IDC**: Food Chemistry	2	3	25	75	100	2
III	I	**22OUITA3**	**Part I:** Tamil	6	3	25	75	100	3
	II	**22OU2EN3**	**Part II:** English	6	3	25	75	100	3
	III	**22OUCH31**	**Core**: General Chemistry-III	4	3	25	75	100	4
	III		**Core**: Practical – II Volumetric Analysis	2	-	-	-	-	-
	III	**22OUCHGEMA3**	**GEC**: Mathematics–III Algebra and Statistics	6	3	25	75	100	4
	III	**22OUCHGEPH3**	**GEC** : Physics –I Mechanics and properties of matter	4	3	25	75	100	4
	III		**GEC** : Physics Practical –I	2	-	-	-	-	-
IV	I	**22OUITA4**	**Part I:** Tamil	6	3	25	75	100	3
	II	**22OU2EN4**	**Part II:** English	6	3	25	75	100	3

	III	**22OUCH41**	**Core**: General Chemistry-IV	4	3	25	75	100	4
	III	**22OUCH4P**	**Core**: Practical – II Volumetric Analysis	2	3	40	60	100	2
	III	**22OUCHGEMA4**	**GEC** : Mathematics– IV Linear Programming	6	3	25	75	100	5
	III	**22OUCHGEPH4**	**GEC**: Physics- II Thermal Physics	4	3	25	75	100	4
	III	**22OUCHGEPH4P**	**GEC** : Physics Practical-I	2	3	40	60	100	1
V	III	**22OUCH51**	**Core**: Organic Chemistry-I	4	3	25	75	100	4
	III	**22OUCH52**	**Core**: Physical Chemistry-I	4	3	25	75	100	4
	III		**DSEC I**	4	3	25	75	100	4
	III	**22OUCH5P**	**Core**: Practical – III Gravimetric Estimation and Organic Preparations	4	6	40	60	100	5
	III		**Core**: Practical – I Physical Chemistry Experiments	4	-	-	-	-	-
	III	**22OUCHGEPH5**	**GEC**: Physics- III Electricity and Electronics	4	3	25	75	100	4
	III		**GEC** : Physics Practical-II	2	-	-	-	-	-
	IV	**22OUCHSE5**	**SEC**: Cheminformatics	2	3	25	75	100	2
	IV	**22OUAECEV5**	**AECC:** Environmental Studies	2	3	25	75	100	2
VI	III	**22OUCH61**	**Core**: Organic Chemistry -II	4	3	25	75	100	4
	III	**22OUCH62**	**Core**: Physical Chemistry-II	4	3	25	75	100	4

	III		**DSEC II**	4	3	25	75	100	4
	III	**22OUCH61P**	**Core:** Practical –IV Physical Chemistry Experiments	4	6	40	60	100	5
	III	**22OUCH62P**	**Core**: Practical – V Organic Analysis & Estimation	4	6	40	60	100	5
	III	**22OUCHGEPH6**	**GEC** : Physics- IV Optics	4	3	25	75	100	4
	III	**22OUCHGEPH6P**	**GEC**: Physics Practical-II	2	3	40	60	100	1
	IV	**22OUCHSE6**	**SEC**: Green and Nano Chemistry	2	3	25	75	100	2
	IV	**22OUAECVE6**	**AECC**: Value Education	2	3	25	75	100	2
	V	**22OU5NS4/** **22OU5PE4**	Extension Activities NSS/ Phy. Education	-	3	25	75	100	1
			Total	180					140

GEC : Generic Elective Course
SEC : Skill Enhancement Course
DSEC : Discipline Specific Elective Course
AECC: Ability Enhancement Compulsory Course
IDC : Inter Disciplinary Course

DSEC: Discipline Specific Elective Course

Semester V (DSEC I- Choose any one)

1. **Inorganic and Analytical Chemistry - 22OUCHDSE5A**
2. Chemistry of Materials - 22OUCHDSE5B

Semester VI (DSEC II- Choose any one)

1. **Inorganic and Applications of Computer in Chemistry - 22OUCHDSE6A**
2. Diffraction Methods and Applications - 22OUCHDSE6B

Annexure-13

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DEPARTMENT OF CHEMISTRY-UG

Generic Elective Course

(For B.Sc., N&D**)**

CBCS with OBE

COURSE STRUCTURE

(w.e.f. 2022 – 2023 Batch onwards)

Semester	Course Code	Title of the Course	(Teaching Hours per week)	(Duration of Exam Hours)	Marks allotted			Credits
					CIA	SE	Total	
III	22OUNDGECH3	**GEC** : Chemistry-I Bio Chemistry	4	3	25	75	100	4
		GEC: Chemistry Practical - I Inorganic Qualitative Analysis	2	-	-	-	-	
IV	22OUNDGECH4	**GEC** : Chemistry-II Environmental and Organic Chemistry	4	3	25	75	100	4
	22OUNDGECH4P	**GEC:** Chemistry Practical - I Inorganic Qualitative Analysis	2	3	40	60	100	1
V	22OUNDGECH5	**GEC :** Chemistry-III Applied Chemistry	4	3	25	75	100	4
		GEC : Chemistry Practical -II Volumetric Analysis	2	-	-	-	-	-
VI	22OUNDGECH6	**GEC** :Chemistry-IV Applied and Medicinal Chemistry	4	3	25	75	100	4
	22OUNDGECH6P	**GEC** : Chemistry Practical - II Volumetric Analysis	2	3	40	60	100	1

Annexure-13

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DEPARTMENT OF CHEMISTRY-UG

Generic Elective Course

(For B.Sc., Physics**)**

CBCS with OBE

COURSE STRUCTURE

(w.e.f. 2022 – 2023 Batch onwards)

Semester	Course Code	Title of the Course	(Teaching hours per week)	(Duration of exam hours)	Marks allotted			Credits
					CIA	SE	Total	
III	22OUPHGECH3	**GEC**: Chemistry –I Physical Chemistry	4	3	25	75	100	4
		GEC: Chemistry Practical - I Inorganic Qualitative Analysis	2	-	-	-	-	
IV	22OUPHGECH4	**GEC**: Chemistry –II Organic and Physical Chemistry	4	3	25	75	100	4
	22OUPHGECH4P	**GEC:** Chemistry Practical -I Inorganic Qualitative Analysis	2	3	40	60	100	1
V	22OUPHGECH5	**GEC** : Chemistry –III Inorganic, Physical and Medicinal Chemistry	4	3	25	75	100	4
		GEC: Chemistry Practical - II Volumetric Analysis	2	-	-	-	-	-
VI	22OUPHGECH6	**GEC** : Chemistry –IV Analytical and Inorganic Chemistry	4	3	25	75	100	4
	22OUPHGECH6P	**GEC:** Chemistry Practical - II Volumetric Analysis	2	3	40	60	100	1

Annexure-13

NOTE:

The students are permitted to obtain additional credits (Optional)

1. MOOCs / SWAYAM / NPTEL Courses (Online)
2. Project

Year	Semester	Title	Duration of Study	Credit
III	VI	Project title	6 months	1

Compulsory Courses:

Year	Semester	Nature of Course	Course Code	Title of the Course	Hours	Offered to students of
I	I	Add on Course	22CHAOC 22CHAOCP	Water Analysis Lab in Water Analysis	30	I B.Sc., Chemistry
II	III&IV	Certificate Course	22CHC 22CHCP	Small Scale Industrial Chemicals Lab in Small Scale Industrial Chemicals	90	II year students of all other disciplines
III	V	Value Added Course	22CHVAC 22CHVACP	Cosmetic Products Lab in Cosmetic Products	30	III B.Sc., Chemistry

Department of Chemistry					Class: III B.Sc chemistry			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
V	Core Course	**22OUCH51**	Organic Chemistry-I	4	4	25	75	100
Nature of the Course								
Knowledge and Skill Oriented			Employability Oriented		Entrepreneurship Oriented			
✓								

Course Objectives

1. To acquire knowledge related to aromatic substitution
2. To learn the aromatic aldehydes, ketones and carboxylic acids
3. To understand organic nitrogen compounds,
4. To know the concept of heterocyclic compounds
5. To study the carbohydrates

Course Content:

UNIT: I AROMATIC SUBSTITUTION: Isomerism and orientation of benzene derivatives-determination of orientation- rules of orientation-electronic interpretation of directive effects-influence of substituents – activating and deactivating groups-mechanism of aromatic electrophilic substitution – halogenation, nitration and sulphonation, Friedel –Craft's reaction (alkylation, acylation) - aromatic nucleophilic substitution–unimolecular, bimolecular substitution and benzyne mechanism.

UNIT: II AROMATIC ALDEHYDES, KETONES AND CARBOXYLIC ACIDS: a) Preparation and properties of benzaldehyde, and acetophenone-Organic naming reactions: Reimer-Tiemann reaction, benzoin condensation, claisen condensation, knoevenagel reaction, cannizzaro reaction, crossed cannizzaro reaction, aldol condensation, perkin reaction -α, β - Unsaturated carbonyl compounds: Preparation, properties and uses of cinnamaldehyde. b) Carboxylic acids: Preparation and properties of benzoic, salicylic, anthranilic and o-phthalic acids.

UNIT: III ORGANIC NITROGEN COMPOUNDS: a) Aromatic amines: Introduction-classification-methods of preparation of primary amines- reduction of nitro compounds and ammonolysis of aryl halides -methods of preparation of secondary and tertiary amines from

aniline, acetanilide-properties: basicity of amines, salt formation, acylation, alkylation and arylation, carbylamine reaction, reaction with aldehyde, CS_2, Grignard reagent, bromination, nitration and sulphonation. Distinguish between primary, secondary and tertiary amines. b) Aromatic nitro compounds: nomenclature, preparation-nitration, from diazonium salts, reactions-reduction of nitrobenzene in different medium, electrophilic substitution reactions. c) Cyanides & Isocyanides: Preparation, properties of alkyl cyanides & alkyl isocyanides. Differences between alkyl cyanides & alkyl isocyanides.

UNIT: IV HETEROCYCLIC COMPOUNDS: Nomenclature and classification, general characteristics-aromatic character and reactivity-Preparation and reactions of pyrrole, furan, thiophene, pyridine, quinolone, isoquinoline and indole.

UNIT: V CARBOHYDRATES: Definition and classification- determination of configuration (Fischer's proof) –glucose, fructose-occurrence, preparation, properties, reactions, structural elucidation and uses-mutarotation-epimerisation- methods of ascending and descending in the sugar series-interconversion between glucose and fructose-disaccharides-sucrose-preparation, properties and structural elucidation- comparison between glucose, fructose and sucrose.

Books for Study:

1. Bahl B.S. & Arun Bahl, (2020) "*Advanced Organic Chemistry*", 22nd Edition, S.Chand & Company, New Delhi.
2. Jain M.K. & Sharma S.C., (2017) "*Modern Organic Chemistry*", Vishal publishing Co, New Delhi.
3. P. L. Soni, and Chawla H.M., (2007) *Text Book of Organic Chemistry*, New Delhi, Sultan Chand & Sons, twenty ninth edition.

Books for Reference:

1. Bansal K., (2012)"*Organic Reaction Mechanisms*", 4th Edition, New Age International Pvt. Ltd., New Delhi,
2. Bhupinder Mehta, Manju Mehta, (2012) "*Organic Chemistry*", PHI Learning Private Limited, New Delhi.
3. Finar I.L., (2003) "*Organic Chemistry*", Volume-I, Pearson Education, New Delhi,

4. Morrison R.T, Boyd R.N and Bhattacharjee S.K, (2010)"*Organic Chemistry*," 7th edn, Pearson Education Asia,

5. Tewari K.S, Vishnoi.N.K and Mehrotra S,N, (2004.) *A Textbook of Organic Chemistry*, 2nd Edition, Vikas Publishing House (Pvt.) Ltd., New Delhi,

Web Resources/e-books:

1.https://www.slideshare.net/slideshow/electrophilic-substitution-reaction-253788576/253788576

2. https://ncert.nic.in/ncerts/l/lech203.pdf

3. https://www.vedantu.com/jee-main/chemistry-organic-compounds-containing-nitrogen

4. https://www.slideshare.net/slideshow/heterocyclic-compoundsppt-259861531/259861531

5. https://byjus.com/chemistry/classification-of-carbohydrates-and-its-structure/

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 enrich the knowledge on aromatic substitution, aromatic aldehydes, ketones and carboxylic acids. To understand about organic nitrogen compounds, heterocyclic compounds and carbohydrates.

Activities to be given: To prepare power point presentation on structure of glucose

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Examine the mechanism of aromatic electrophilic substitution reactions	K1 to K3
CLO 2	Explain the preparation and properties of aldehydes and ketones	K1 to K3
CLO 3	Distinguish between alkylcyanides and alkylisocyanides	K1 to K4
CLO 4	Discuss the preparation and properties of	K1 to K3
CLO 5	Elucidate the structure of glucose and fructose	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)

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

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

Unit	Description	Hours	Mode
I	Isomerism and orientation of benzene derivatives-determination of orientation- rules of orientation-electronic interpretation of directive effects. influence of substituents – activating and deactivating groups-mechanism of aromatic electrophilic substitution – halogenation, nitration and sulphonation, Friedel –Craft's reaction (alkylation, acylation aromatic nucleophilic substitution– unimolecular, bimolecular substitution and benzyne mechanism.	12	Chalk and Talk, PPT
II	a) Preparation and properties of benzaldehyde, and acetophenone- Organic naming reactions: Reimer-Tiemann reaction, benzoin condensation, claisen condensation, knoevenagel reaction, cannizzaro reaction, crossed cannizzaro reaction, aldol condensation, perkin reaction -α, β - Unsaturated carbonyl compounds: Preparation and properties of cinnamaldehyde. b) Carboxylic acids: Preparation and properties of benzoic, salicylic, anthranilic and o-phthalic acids.	12	Chalk and Talk, PPT, group discussion

III	a) Aromatic amines: Introduction- classification-methods of preparation of primary amines- reduction of nitro compounds and ammonolysis of aryl halides -methods of preparation of secondary and tertiary amines from aniline, acetanilide-properties: basicity of amines, salt formation, acylation, alkylation and arylation, carbylamine reaction, reaction with aldehyde, CS_2, Grignard reagent, bromination, nitration and sulphonation. Distinguish between primary, secondary and tertiary amines. b) Aromatic nitro compounds: nomenclature, preparation-nitration, from diazonium salts, reactions- reduction of nitrobenzene in different medium, electrophilic substitution reactions. c) Cyanides & Isocyanides: Preparation, properties of alkyl cyanides & alkyl isocyanides. Differences between alkyl cyanides & alkyl isocyanides.	12	Chalk and Talk, PPT
IV	Nomenclature and classification, general characteristics-aromatic character and reactivity. Preparation and reactions of pyrrole, furan, thiophene, pyridine, quinolone, isoquinoline and indole.	12	Chalk and Talk, PPT and Seminar
V	Definition and classification- determination of configuration (Fischer's proof) –glucose, fructose-occurrence, preparation, properties, reactions, structural elucidation and uses- mutarotation-epimerisation- methods of ascending and descending in the sugar series-interconversion between glucose and fructose-disaccharides-sucrose-preparation, properties and structural elucidation-comparison between glucose, fructose and sucrose.	12	Chalk and Talk, PPT
	Total hours	60	

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

Department of Chemistry					Class: III B.Sc chemistry			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
V	Core Course	**22OUCH52**	Physical Chemistry- I	4	4	25	75	100

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

Course Objectives

1. To acquire knowledge about first law of thermodynamics and its applications.
2. To understand second law of thermodynamics, entropy and free energy.
3. To gain knowledge about phase rule and solutions.
4. To understand colligative properties.
5. To learn the fundamentals of group theory and its applications.

Course Content:

UNIT: I THERMODYNAMICS-I: a) Importance of thermodynamics-concepts of a system, surroundings-state variables-extensive, intensive properties-different types of processes-isothermal, adiabatic, isobaric, isochoric, reversible, irreversible processes and cyclic. First law of thermodynamics-concept and significance of heat(q), work(w), internal energy(E), enthalpy(H)-heat capacity at constant P and V- Relation between C_p and C_v-work done in reversible isothermal expansion and compression of an ideal gas –maximum work- work done in irreversible isothermal expansion and adiabatic expansion of an ideal gas. The Joule-Thomson effect, Joule Thomson coefficient for real and ideal gas. b) Zeroth law of thermodynamics-absolute temperature scale.

UNIT: II THERMODYNAMICS-II: a) Second law of thermodynamics: limitations of first law, spontaneity and randomness-Carnot cycle-Carnot's theorem-entropy as a thermodynamic property-Clausius inequality-calculation of entropy change of an ideal gas with change in P,V and T – Entropy changes of an ideal gas in different process –Physical significance of entropy – Work and free energy functions – Variation of free energy change with temperature & pressure – Maxwell's relationships – The Gibbs- Helmholtz equation– The Clapeyron- Clausis equation and its applications. Van't Hoff isotherm- Van't Hoff isochore.b) Third law of thermodynamics: Nernst

heat theorem – Statement of Third law of Thermodynamics, determination of absolute entropy of solid, liquid and gas.

UNIT: III PHASE RULE AND SOLUTIONS: a) Statement and significance of the terms involved. Derivation of phase rule from thermodynamic derivation-application of phase rule to one-component system (water, sulphur system only). b) Two component systems-simple eutectic system (lead-silver system only)-compound formation-congruent melting point (Mg-Zn system only), salt hydrates ($FeCl_3$-H_2O system only).-incongruent melting point (KI-H_2O system only). c) Thermodynamics of ideal solutions-Henry's law, Raoult's law-binary liquid system-partially miscible (phenol-water system)-effect of impurities on critical solution temperature- completely miscible and completely immiscible system-theory of fractional distillation and steam distillation.

UNIT: IV COLLIGATIVE PROPERTIES: Colligative properties –lowering of vapour pressure – osmosis and osmotic pressure –elevation of boiling point –depression in freezing point – experimental determination of lowering of vapour pressure and osmotic pressure – Van't Hoff factor – degree of association – degree of dissociation**.**

UNIT: V GROUP THEORY: Introduction-symmetry elements and symmetry operations- rules of a group, order of a group - classes and similarity transformation- point group classification (C_1,C_2,C_3,C_{nv},D_{nh},T_d,O_h) – matrix representation of symmetry operation- rotation & reflection– reducible and irreducible representation (definition only)- Orthogonality theorem **-** construction of character table (C_{2v} only).

Books for Study:

1. Bhattacharya P.K., (1996) "*Group Theory and applications*", Himalaya Publishing House, Mumbai,.
2. Puri B.R, Sharma L.R and Pathania S, (2010) "*Principles of Physical Chemistry*", Vishal Publishing Co., New Delhi,.
3. Ramakrishnan V. and Gopinathan M.S.,(2007) "*Group Theory in Chemistry*", Vishal Publishing Company,.

Books for Reference:

1. Arun Bahl, Bahl B.S and Tuli G.D.,(2009) "*Essentials of Physical chemistry"* S.Chand &Co Ltd, New Delhi,.
2. Soni P.L., Dharmarha O.P.(2001), "*Text Book of Physical Chemistry*", Sultan Chand & Sons, New Delhi,
3. Rajaram.J and Kuriacose J.C, (2013) "*Chemical Thermodynamics*", Pearson Education, New Delhi,.
4. Atkins P.W, Paula, (2017) "*Elements of Physical Chemistry*", Oxford University Press,

Web Resources/e-books:

1. https://www.gbcramgarh.in/e-learning-study materials/chem/Principle%20of%20Physical%20chemistry%20by%20Puri%20Sharma%20Pathania%20(z-lib.org)%20(1).pdf
2. https://ia801009.us.archive.org/26/items/chemicalthermodynamicsbasicconceptsandmethods_201908/Chemical%20Thermodynamics%20%20Basic%20Concepts%20and%20Methods.pdf
3. https://elearn.daffodilvarsity.edu.bd/pluginfile.php/388879/mod_resource/content/1/Essentials%20Of%20Physical%20Chemistry%20%20Arun%20Bahl%20%20B.s.%20Bahl.pdf
4. https://www.researchgate.net/publication/337797765_A_Textbook_of_Physical_Chemistry_-_Volume_1
5. https://www.researchgate.net/publication/258643416_Introduction_to_group_theory

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 enrich understanding the capacity in fundamental concepts of state variables, types of process and laws in thermodynamics, phase rule in different system, von't hoff factor and character tables for group theory.

Activities to be given: To demonstrate osmotic pressure using chart activity.

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Ability to understand the basic concepts of thermodynamic such as temperature, pressure, system, properties, process, state, cycles and equilibrium.	K1 to K3
CLO 2	Discuss the laws of thermodynamics and entropy concept analysing the thermal efficies of heat engines such as carnot cycle.	K1 to K3
CLO 3	Explain the definition and basic terms in phase diagram.	K1 to K4
CLO 4	Explain lowering vapour pressure, osmotic pressure, Van't Hoff factor, degree of association.	K1 to K3
CLO 5	Illustrate the rotation axis, different symmetry elements and symmetry operations associated with a molecules. Concepts of a group, procedure for classification of molecules into point groups.	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)

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

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

Annexure-13

LESSON PLAN: TOTAL HOURS (60 Hrs)

Unit	Description	Hours	Mode
I	**UNIT: I THERMODYNAMICS-I:** a) Importance of thermodynamics-concepts of a system, surroundings, energy-state variables-extensive intensive properties-different types of processes-isothermal, adiabatic, isobaric, isochoric, reversible, irreversible processes and cyclic. First law of thermodynamics-concept and significance of heat(q), work(w), internal energy(E), enthalpy(H)- heat capacity at constant P and V- Relation between C_p and C_v-work done in reversible isothermal expansion and compression –maximum work- work done in irreversible isothermal expansion and adiabatic expansion. The Joule-Thomson effect, Joule Thomson coefficient for real and ideal gas. b) Zeroth law of thermodynamics-absolute temperature scale.	12	Chalk and Talk, PPT
II	**UNIT: II THERMODYNAMICS-II:** a) Second law of thermodynamics: limitations of first law, spontaneity and randomness-Carnot cycle-Carnot's theorem-entropy as a thermodynamic property-Clausius inequality-calculation of entropy change of an ideal gas with change in P,V and T – Entropy changes of an ideal gas in different process –Physical significance of entropy – Work and free energy functions – Variation of free energy change with temperature & pressure – Maxwell's relationships – The Gibbs-Helmholtz equation– The Clapeyron- Clausis equation and its applications. Van't Hoff isotherm- Van't Hoff isochore.b) Third law of thermodynamics: Nernst heat theorem – Statement of Third law of Thermodynamics, determination of absolute entropy of solid, liquid and gas.	12	Chalk and Talk, PPT, group discussion
III	**UNIT: III PHASE RULE AND SOLUTIONS:** a) Statement and significance of the terms involved. Derivation of phase rule from thermodynamic derivation-application of phase rule to one-component system (water, sulphur system only). b) Two component systems-simple eutectic system (lead-silver system only)-compound formation-congruent melting point (Mg-Zn system only), salt hydrates ($FeCl_3$-H_2O system only).-incongruent melting point (KI-H_2O system only). c) Thermodynamics of ideal solutions-Henry's law, Raoult's law-binary liquid system-partially miscible (phenol-water system)-effect of impurities on critical solution temperature-completely miscible and completely immiscible system-theory of fractional distillation and steam distillation.	12	Chalk and Talk, PPT
IV	**UNIT: IV COLLIGATIVE PROPERTIES:** Colligative properties –lowering of vapour pressure – osmosis and osmotic pressure –elevation of boiling point –depression in freezing point – experimental determination of lowering of vapour pressure and osmotic pressure – Van't Hoff factor – degree of association – degree of dissociation**.**	12	Chalk and Talk, PPT and Seminar

V	**UNIT: V GROUP THEORY:** Introduction-symmetry elements and symmetry operations- rules of a group, order of a group - classes and similarity transformation- point group classification (C_1,C_2,C_3,C_{nv},D_{nh},T_d,O_h) – matrix representation of symmetry operation- rotation & reflection– reducible and irreducible representation (definition only)- Orthogonality theorem - construction of character table (C_{2v} only).	12	Chalk and Talk, PPT
	Total Hours	60	

Course Designer: Dr.(Mrs).A.Ramya

Annexure-13

Department of Chemistry					Class: III B.Sc chemistry			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
V	DSEC-I	22OUCHDSE5A	Inorganic and Analytical Chemistry	4	4	25	75	100

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

Course Objectives

1. To acquire knowledge about Halogen compounds
2. To understand the fundamental concepts of transition elements
3. To study the non-aqueous solvents and inorganic polymers
4. To understand the knowledge about chromatographic technique and colorimetric methods of analysis
5. To understand the data analysis and thermoanalytical methods

Course Content:

UNIT: I HALOGEN COMPOUNDS: a) Halogen compounds: Electronic configuration, diatomic nature, oxidizing property, electronegativity and electron affinity –Difficulties in the discovery and isolation of fluorine – peculiarities of fluorine – electropositive character of Iodine b) Interhalogen Compounds: Interhalogen compounds: preparation, properties of ClF, ICl, ClF_3, ClF_5, BrF_5, IF_5, IF_7 – structure of ICl, ClF_3, IF_5, IF_7- poly halides and pseudo halogens.

UNIT: II TRANSITION ELEMENTS: a) Transition elements –position in the periodic table – general characteristics of d-block elements. b) Occurrence, extraction, properties and uses of titanium, molybdenum and tungsten. c) Chemistry of titanium dioxide, titanium tetrachloride, vanadium pentoxide-ammonium vanadate, ammonium molybdate, molybdenum blue, tungsten oxide and tungsten bronze. d) Lanthanides and Actinides-General characteristics of lanthanides and actinides. Lanthanide and actinides, separation by ion-exchange and solvent extraction methods–lanthanide contraction-actinide contraction.

UNIT: III NON-AQUEOUS SOLVENTS & INORGANIC POLYMERS a) Non-aqeous solvents: Classification of solvents-general properties of ionizing solvents-chemical reactions-liquid ammonia as solvents-liquid sulphur dioxide as solvents-liquid hydrogen fluoride as solvents.

b) Inorganic polymers: Introduction-general properties of inorganic polymers -silicon based polymers-polysilaxane gums and silicon rubber-industrial applications of inorganic polymer.

UNIT: IV CHROMATOGRAPHY AND COLORIMETRIC METHODS OF ANALYSIS: a) Chromatography: Definition- principle of chromatography- types of chromatography- experimental techniques and applications of column chromatography- thin layer chromatography and paper chromatography- R_f value and factors affecting R_f value**.** b) Colorimetric method of analysis: Introduction- principle- Beer- Lambert's law- criteria for satisfactory colorimetric estimations- Duboscq colorimeter- estimation of Fe^{3+} ion**.**

UNIT: V DATA ANALYSIS AND THERMOANALYTICAL METHODS: a) Data analysis: Introduction-mean –median-precision-accuracy-confidence limits- definition –determinate errors-indeterminate errors-rules for types improving accuracy of data-significant figure-method of least squares. b) Thermoanalytical methods: Introduction- Thermogravimetric analysis (TGA) – principle –thermal analysis of silver nitrate-derivative thermogravimetry (DGA)-factors which influence the thermogram- application of thermogravimetry.

Books for Study:

1. Gopalan R. Subramanian P.S. & Rengarajan K., (2003) "*Elements of Analytical Chemistry*" S.Chand & Sons , New Delhi,.
2. Madan R.D,(2011) "*Modern Inorganic Chemistry*", S.Chand and Company Ltd., New Delhi,.
3. Puri B.R. Sharma L.R. Kalia K.C. (2016.) "*Principles of Inorganic Chemistry*", Milestone Publishers, Delhi,

Books for Reference:

1. Gurdeep R. Chatwal & Sham K. Anand., (2002)"*Instrumental methods of chemical analysis*". Himalaya publishing house, Mumbai.
2. Lee J.D., (2003) "*Concise Inorganic Chemistry*", Fifth Edition, Blackwell Science Ltd., New Delhi,.
3. Malik U. Tuli G.D. & Madan R.L.,(2004). "*Selected Topics in Inorganic Chemistry*," S.Chand & Company, New Delhi,

Web Resources/e-books:

1. **http://www.vpscience.org/materials/Study%20Material%20on%20d%20Inter-halogen%20%20Compounds%20By%20Dr.%20D.%20M.%20Patel.pdf**

2. **https://www.eng.uc.edu/~beaucag/Classes/AdvancedMaterialsThermodynamics/Books/Cotton%20F.,%20Wilkinson%20G.,%20Murillo%20C.,%20Bochmann%20M.%20-%20Advanced%20inorganic%20chemistry John%20Wiley%20&%20Sons%20(1999).pdf**
3. **https://www.uou.ac.in/sites/default/files/slm/BSCCH-101.pdf**
4. **http://www.vpscience.org/materials/US03CCHE21%20Unit-1(B)%20Non%20Aq%20Solvents.pdf**
5. **https://tech.chemistrydocs.com/Books/Analytical/Analytical-Chemistry-By-D-Kealey-and-P-J-Haines.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 understanding the preparation, properties and structure of interhalogen compounds, occurrence and extraction of transition elements, extraction of lanthanides and actinides by ion exchange method, inorganic polymers and application of TGA.

Activities to be given: To calculate the electronic configuration of halogen and interhalogen compounds.

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Calculate the electronic configuration, preparation in halogen compounds, properties of interhalogen compounds and pseudo halogen compounds.	K1 to K3
CLO 2	Understand the occurrence, extraction, preparation, properties and uses of transition elements in tungsten, vanadium and molybdinum	K1 to K3
CLO 3	Explain the general characters and contraction of lanthanides and actinides.	K1 to K4
CLO 4	Classify solvents. Explain polysilxane gum and silicone rubber.	K1 to K3
CLO 5	Determine the errors. To analyse thermal decomposition of silver nitrate using TGA and application of thermogravimetry.	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)

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

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

Unit	Description	Hours	Mode
I	**HALOGEN COMPOUNDS:** a) Halogen compounds: Electronic configuration, diatomic nature, oxidizing property, electronegativity and electron affinity–Difficulties in the discovery and isolation of fluorine – peculiarities of fluorine – electropositive character of Iodine b) Interhalogen Compounds: Interhalogen compounds: preparation, properties of ClF, ICl, ClF_3, ClF_5, BrF_5 ,IF_5, IF_7 – structure of ICl, ClF_3, IF_5, IF_7- poly halides and pseudo halogens.	12	Chalk and Talk, PPT
II	**TRANSITION ELEMENTS:** a) Transition elements –position in the periodic table –general characteristics of d-block elements. b) Occurrence, extraction, properties and uses of titanium, molybdenum and tungsten. c) Chemistry of titanium dioxide, titanium tetrachloride, vanadium pentoxide-ammonium vanadate, ammonium molybdate, molybdenum blue, tungsten oxide and tungsten bronze. d) Lanthanides and Acdinides-General characteristics of lanthanides and actinides. Lanthanide and actinides, separation by ion-exchange and solvent extraction methods–lanthanide contraction-actinide contraction.	12	Chalk and Talk, PPT, group discussion
III	**NON-AQUEOUS SOLVENTS & INORGANIC POLYMERS** a) Non-aqeous solvents: Classification of solvents-general properties of ionizing solvents-chemical reactions- liquid ammonia	12	Chalk and Talk, PPT,

	as solvents-liquid sulphur dioxide as solvents-liquid hydrogen fluoride as solvents. b) Inorganic polymers: Introduction-general properties of inorganic polymers -silicon based polymers-polysilaxane gums and silicon rubber-industrial applications of inorganic polymer.		
IV	**CHROMATOGRAPHY AND COLORIMETRIC METHODS OF ANALYSIS:** a) Chromatography: Definition- principle of chromatography- types of chromatography- experimental techniques and applications of column chromatography- thin layer chromatography and paper chromatography- R_f value and factors affecting R_f value**.** b) Colorimetric method of analysis: Introduction-principle- Beer- Lambert's law- criteria for satisfactory colorimetric estimations- Duboscq colorimeter- estimation of Fe^{3+} ion.	12	Chalk and Talk, PPT and Virtual Lab.
V	**DATA ANALYSIS AND THERMOANALYTICAL METHODS:** a) Data analysis: Introduction-mean –median-precision-accuracy-confidence limits- definition –determinate errors- indeterminate errors-rules for types improving accuracy of data-significant figure-method of least squares. b) Thermoanalytical methods: Introduction- Thermogravimetric analysis (TGA) –principle –thermal analysis of silver nitrate-derivative thermogravimetry (DGA)-factors which influence the thermogram-application of thermogravimetry.	12	Chalk and Talk, PPT
	Total Hours	60	

Course Designer: 1. Dr.(Mrs).A.Ramya

Annexure-13

Department of Chemistry						Class: III B.Sc Chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
V	DSEC-I	22OUCHDSE5B	Chemistry of Materials	4	4	25	75	100

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

Course Objectives:

1. To understand about structures of solids.
2. To study about preparative method and characterization.
3. To learn the electrical and optical properties.
4. To gain knowledge about magnetic properties.
5. To study the special materials.

Course Content:

UNIT: I STRUCTURES OF SOLIDS : Introduction to solids – Crystalline and amorphous. Unit cell, Bravais lattices and X-ray structure determination (NaCl and KCl only) – powder and single crystal methods. Radius ratio rules – coordination number. Packing arrangement – different structure types in solids – rock salts, zinc blonde, wurtzite, spinel and inverse – spinel and perovskite structures.

UNIT: II PREPARATIVE METHOD AND CHARACTERIZATION: Solid state reactions – ceramic method, sol- gel hydrothermal, high pressure, zone refining, CVD, Czochralski and Bridgman and stockbarger methods. Physical methods – thermogravimetric and differential thermal analysis and scanning electron microscopy (only introduction and applications)

UNIT: III ELECTRICAL AND OPTICAL PROPERTIES: Defects in solid state – point defects – Frenkel and Schottky defects and non-stoichiometric defects. Conductors – variation of conductivity with temperature – semiconductors – p and n types, pn-junction, photoconduction, photo voltaic cell and photogalvanic cell – solar energy conversion, organic semiconductors. Piezoelectric, pyro-electric and ferroelectrics (introduction and applications) Photolumionescence.

UNIT:IV MAGNETIC PROPERTIES: Magnetic properties – classification – diamagnetic, paramagnetic, antiferro magnetic, ferro and ferri magnetic – magnetic susceptibility – variation with temperature Curie-Wiess law, Curie temperature and Neel temperature. Permanent and temporary magnets.

UNIT: V SPECIAL MATERIALS: Super conductivity – introduction, Meissner effect – mention of Bardeen, Cooper and Schrieffer theory and Cooper pairs – examples of superconducting oxides, Chevrel phases – applications of superconducting materials. Ionic conductors – sodium-b alumina, sodium-sulphur battery. Intercalation-layered compounds – graphitic compounds. Special applications of solid state materials. High energy battery, lithium cells.

Books for study:

1. Meyers H.P.,(2009) "*Introductory Solid State Physics*", 2nd Edn, Viva books private Limited, New Delhi.
2. West A.R., (2014) "*Solid State Chemistry and its Applications"*, 2nd Edn, John-Wiley and sons Singaporer.

Books for Reference:

1. Emelius H.J. & Sharpe A.G., (2010) "*Modern aspects of Inorganic Chemistry*", Universal Book Stall.
2. Greenwood N.N., (2003) "*Ionic crystals, Lattice defects and Nonstoichiometry*",Butterworths, London.
3. Jolly W.L., (1996) "*Modern Inorganic Chemistry*", Mc Graw Hill Book Company New York.
4. Shriver D.F & Atkins P.W.,(2008) "*Inorganic Chemistry*", Oxford University, Longford.

Web Resources/e-books:

1. **https://prog.lmu.edu.ng/colleges_CMS/document/books/MCE321%20-%20Structure%20of%20Solid.pdf**
2. **https://pubs.acs.org/doi/pdf/10.1021/ed057p531**
3. **https://link.springer.com/chapter/10.1007/978-1-349-10187-0_4**
4. **https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Physical_Properties_of_Matter/Atomic_and_Molecular_Properties/Magnetic_Properties**

5. **https://www.binzel-abicor.com/IN/eng/solutions/material/special-material/#:~:text=Titanium%2C%20zirconium%2C%20nickel%2C%20copper%20and%20more&text=Also%2C%20many%20nickel%20and%20nickel,reducing%20media%20such%20as%20acids.**

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 enrich the knowledge about different types of solids, characterization of solid state materials, different types of properties including electrical, optical and magnetic properties and applications of battery.

Activities to be given: To prepare NaCl and KCl structure using chem model set.

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Understand typical ionic crystal structure. Compare the properties of crystalline and amorphous solid.	K1 to K3
CLO 2	Gain the knowledge about preparation methods and application of DTA and SEM.	K1 to K3
CLO 3	Compare frenkel and schottky defects, conductors and semiconductors.	K1 to K4
CLO 4	To find out different types of magnetic properties.	K1 to K3
CLO 5	Gain knowledge of lithium battery, graphite compounds.	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-13

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

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

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

Unit	Description	Hours	Mode
I	**UNIT: I STRUCTURES OF SOLIDS:** Introduction to solids – Crystalline and amorphous. Unit cell, Bravais lattices and X-ray structure determination (NaCl and KCl only) – powder and single crystal methods. Radius ratio rules – coordination number. Packing arrangement – different structure types in solids – rock salts, zinc blonde, wurtzite, spinel and inverse – spinel and perovskite structures.	12	Chalk and Talk, PPT
II	**UNIT: II PREPARATIVE METHOD AND CHARACTERIZATION:** Solid state reactions – ceramic method, sol- gel hydrothermal, high pressure, zone refining, CVD, Czochralski and Bridgman and stockbarger methods. Physical methods – thermogravimetric and differential thermal analysis and scanning electron microscopy (only introduction and applications)	12	Chalk and Talk, PPT, group discussion

III	**UNIT: III ELECTRICAL AND OPTICAL PROPERTIES:** Defects in solid state – point defects – Frenkel and Schottky defects and non-stoichiometric defects. Conductors – variation of conductivity with temperature – semiconductors – p and n types, pn-junction, photoconduction, photo voltaic cell and photogalvanic cell – solar energy conversion, organic semiconductors. Piezoelectric, pyro-electric and ferroelectrics (introduction and applications) Photolumionescence.	12	Chalk and Talk, PPT
IV	**UNIT:IV MAGNETIC PROPERTIES:** Magnetic properties – classification – diamagnetic, paramagnetic, antiferro magnetic, ferro and ferri magnetic – magnetic susceptibility – variation with temperature Curie-Wiess law, Curie temperature and Neel temperature. Permanent and temporary magnets.	12	Chalk and Talk, PPT and Seminar
V	**UNIT: V SPECIAL MATERIALS:** Super conductivity – introduction, Meissner effect – mention of Bardeen, Cooper and Schrieffer theory and Cooper pairs – examples of superconducting oxides, Chevrel phases – applications of superconducting materials. Ionic conductors – sodium-b alumina, sodium-sulphur battery. Intercalation-layered compounds – graphitic compounds. Special applications of solid state materials.High energy battery, lithium cells.	12	Chalk and Talk, PPT
	Total Hours	60	

Course Designer: 1. Dr.(Mrs).A.Ramya

Annexure-13

Department of Chemistry						Class: III B.Sc Chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
V	Core Course lab	**22OUCH5P**	Gravimetric Estimation and Organic Preparations	5	4	40	60	100

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

Course Objectives:

1. To acquire knowledge about gravimetric estimations
2. To understand basic knowledge about preparation of organic compounds

Course Content:

i) Gravimetric Analysis:

List of experiments:

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of calcium as calcium oxalate monohydrate
4. Estimation of Ni as nickel dimethyl glyoxime

ii) Preparation of Organic Compounds

i. Glucosazone from Glucose
ii. Acetylation -acetanilide from aniline
iii. Oxidation - benzoic acid from Benzaldehyde
iv. Methyl benzoate to Benzoic acid
v. Salicylic acid from Methyl Salicylate
vi. Hydrolysis of Benzoic Acid from Benzamide

Books for Reference:

1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. (2012), "*Basic Principles of Practical Chemistry*", 2nd ed.; Sultan Chand: New Delhi.
2. Manna, A.K. (2018), "*Practical Organic Chemistry"*, Books and Allied: India.

3. Gurtu, J. N; Kapoor, R. (1987), "*Advanced Experimental Chemistry (Organic)"*, Sultan Chand: New Delhi.,
4. Furniss,B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. Vogel's (1989), "*Textbook of Practical Organic Chemistry"*, 5th ed.; Pearson: India.

Web resources/E-books:

1.https://ww.vlab.co.in/broad-area-chemical-sciences

2. https://vlab.amrita.edu/?sub=2&brch=193&sim=348&cnt=1

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

S.No	Description	Hrs	Mode
1	Instructions	6	Chalk and Talk, Demonstration
2	Estimation of lead as lead chromate	4	Chalk and Talk, Discussion, Procedure with illustration
3	Estimation of barium as barium chromate	4	Chalk and Talk, Discussion, Procedure with illustration
4	Estimation of calcium as calcium oxalate monohydrate	4	Chalk and Talk, Discussion, Procedure with illustration
5	Preparation of Organic Compounds: Introductions	6	Chalk and Talk, Discussion, Procedure with illustration
6	Glucosazone from Glucose	4	Chalk and Talk, Discussion, Procedure with illustration
7	Acetylation -acetanilide from aniline	4	Chalk and Talk, Discussion, Procedure with illustration
8	Oxidation - benzoic acid from Benzaldehyde	4	Chalk and Talk, Discussion, Procedure with illustration
9	Methyl benzoate to Benzoic acid	4	Chalk and Talk, Discussion, Procedure with illustration
10	Salicylic acid from Methyl Salicylate	4	Chalk and Talk, Discussion, Procedure with illustration
11	Hydrolysis of Benzoic Acid from Benzamide	4	Chalk and Talk, Discussion, Procedure with illustration
12	Model	12	
	Total	60	

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

2. Ms.K.Punitha

Annexure-13

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-gravimetric estimation and organic preparation	10
2	Procedure for gravimetric estimation and organic preparations	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- gravimetric estimation	20
2	Experiment- Organic preparations	10
2	Procedure for gravimetric estimation and organic preparations	10
3.	Viva	10
4.	Record note	10
	Total	**60**

Distribution of marks for gravimetric estimation

Procedure (5marks)
Estimation (20marks)
Error <2% - 20 marks
Error 2-3% -15 marks
Error 3-4% -10 marks
Error >4% -5 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-13

Department of Chemistry					Class: III B.Sc Chemistry			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
V	Skill Enhancement Course	**22OUCHSE5**	Cheminformatics	2	2	25	75	100

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

Course Objectives

1. To learn the computational chemistry.
2. To gain knowledge in protein databank and drug discovery
3. To study about drug design.
4. To understand the discovery and development, target identification
5. To study the permeability barriers and detoxification.

Course Content:

UNIT I: COMPUTATIONAL CHEMISTRY: Introduction –proteins- properties, structure, classification and Function-Amino acids- classification, acid base character of amino acids - synthesis, degradation – Favourable Interactions in Proteins – non-covalent -protein stability – factors affecting protein stability. protein structure deamination –X-ray crystallography method.

UNIT II: PROTEIN DATABANK AND DRUG DISCOVERY: protein databank (pdb): introduction- pdb file format- HEADER, TITLE and AUTHOR records - REMARK records - SEQRES records - ATOM records - HETATM records. **Drug discovery**-introduction-drug discovery process- drug development – stages of drug development process.

UNIT-III DRUG DESIGN: Drug design: introduction – types –ligand and structure based drug design – experimental methods- active site identification–ligand fragment link- scoring method – computer aided drug design- - flow chat of usual clustering analysis for structure based drug design-molecular modeling in drug discovery- goal, applications –important characteristic of models – computable quantities. Cheminformatics – introduction- need and important of cheminformatics - scope of cheminformatics – applications.

UNIT IV: DRUG: Introduction- phases stages -discovery and development, preclinical research: absorption, distribution, disposition, metabolism, & excretion, in vivo, in vitro & Ex vivo assays,

drug delivery, parenteral (IM, SC or LP Membrane), formulation optimization & improving bioavailability - clinical development : clinical trials, biological samples collection, storage & shipment, bioanalytical method development and validation, blood, plasma, urine & feces sample analysis for drug and metabolites- FDA review: IND application, orphan drug , reasons for drug failure - post-market monitoring.

UNIT V: DRUG METABOLISM: introduction - permeability barriers and detoxification - phases of detoxification - phase I– modification- oxidation, reduction, hydrolysis - phase II – conjugation - phase III– further modification and excretion - endogenous toxins, sites, factors that affect drug metabolism- pharmacokinetics and pharmacodynamics-definition only.

Books for study:

1. Andrew R., Leach Valerie J. & Gillet,(2007) "*An Introduction to Chemoinformatics",* Springer International Edition,.
2. Amalia Stefaniu , Azhar Rasul , Ghulam Hussain .,(2022) "*Cheminformatics and its Applications Hard* ", info teach Publishing Co., New Delhi.
3. Shanmugam S.,(2011), "*Nanotechnology*", MJP publishers, Chennai,

Books for Reference:

1. Ahulwalia V.K. Kidwai M., (2012) "*New Trends in Green Chemistry*", Second Edition, Anamaya Publishers, New Delhi,.
2. Kenneth & Klabunde J, (2001), "*Nanoscale Materials in Chemistry*", Wiley Interscience, Publication, New York
3. Ownes F.J., (2003),"*Introduction to Nanotechnology*", Wiley publication, USA.

Web Resources/e-books:

1. **https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBI1209.pdf**
2. **http://www.acad.bg/ebook/cheminformatics/Leach_An%20Introduction%20to%20Chemoinformatics%20Rev%20Ed.pdf**
3. **https://www.fkkt.um.si/ukemat/Gasteiger-Chemoinfo.pdf**
4. **https://infochim.u-strasbg.fr/CS3/program/material/Ertl.pdf**
5. **https://www.semanticscholar.org/paper/A-Study-on-Cheminformatics-and-its-Applications-on-Begam-Kumar/29f835a83d015d6264cb2d7927ce73c2cb405ccf**

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 enrich the knowledge about computational chemistry, protein databank and drug discovery, drug design, drug and drug metabolism.

Activities to be given: To prepare power point presentation on drug design process

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Understand the properties, structure, classification and function of amino acids.	K1 to K3
CLO 2	Discuss the protein databank (pdb) and pdb file format	K1 to K3
CLO 3	Explain the low chat of usual clustering analysis for structure based drug design	K1 to K4
CLO 4	find out drug discovery and development, target identification and validation	K1 to K3
CLO 5	Gain the knowledge permeability barriers and detoxification	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)

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

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

Annexure-13

LESSON PLAN: TOTAL HOURS (30 Hrs)

Unit	Description	Hours	Mode
I	**COMPUTATIONAL CHEMISTRY:** Introduction –proteins-properties, structure, classification and Function-Amino acids-classification, acid base character of amino acids –peptide bonds-synthesis, degradation – Favourable Interactions in Proteins – non-covalent -protein stability –factors affecting protein stability. protein structure deamination –X-ray crystallography method.	6	Chalk and Talk, PPT
II	**PROTEIN DATABANK AND DRUG DISCOVERY**: protein databank (pdb): introduction- pdb file format introduction- header, title and author records - remark records - seqres records - atom records - hetatm records. **DRUG DISCOVERY**-introduction-drug discovery process- drug development - drug development process. stages of drug discovery.	6	Chalk and Talk, PPT, group discussion
III	**DRUG DESIGN:** Drug design: introduction – types –structure based drug design – experimental methods- active site identification–ligand fragment link- scoring method – rational drug discovery –computer aided drug design- - flow chat of usual clustering analysis for structure based drug design-molecular modeling in drug discovery- goal, applications –important characteristic of models – computable quantities. cheminformatics – introduction- need and important of cheminformatics - scope of chemo informatics – applications.	6	Chalk and Talk, PPT
IV	**Drug**: Introduction- phases stages -discovery and development, target identification and validation, hit discovery process, assay development and screening lead optimization and active pharmaceutical ingredients- preclinical research- absorption, distribution, disposition, metabolism, & excretion, in vivo, in vitro & ex vivoassays, drug delivery, parenteral (im, sc or lp membrane), formulation optimization & improving bioavailability - clinical development - clinical trials, biological samples collection, storage & shipment, bioanalytical method development and validation, blood, plasma, urine & feces sample analysis for drug and metabolites- FDA review- in	6	Chalk and Talk, PPT and Seminar

	application, orphan drug , reasons for drug failure - post-market monitoring.		
V	**Drug Metabolism:** introduction - permeability barriers and detoxification - phases of detoxification - phase I– modification-oxidation , reduction, hydrolysis - phase II – conjugation - phase III– further modification and excretion - endogenous toxins, sites, factors that affect drug metabolism- pharmacokinetics and pharmacodynamics**.**	6	Chalk and Talk, PPT
	Total Hours	30	

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

Department of Chemistry					Class: III B.Sc Chemistry			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
VI	Core course	**22OUCH61**	Organic Chemistry- II	4	4	25	75	100
Nature of the Course								
Knowledge and Skill Oriented			Employability Oriented		Entrepreneurship Oriented			
✓								

Course Objectives

1. To gain knowledge on active methylene compounds and dyes.
2. To acquire an in-depth knowledge related to alicyclic compounds,
3. To provide knowledge on molecular rearrangement, tautomerism and their mechanisms.
4. To understand the chemistry and applications of biologically important compounds such as alkaloids and terpenoids.
5. To understand the application of spectroscopy in UV, IR and NMR.

Course Content:

UNIT: I REACTIVE METHYLENE COMPOUNDS and DYES: a) Reactive methylene compounds: Introduction- Preparation &synthetic applications of acetoacetic ester & malonic ester. b) Dyes: Introduction to dyes – color and constitution – classification based on structure and application – preparation and applications of the following dyes – methyl orange, congo red, malachite green, phenolphthalein and indigo**.**

UNIT: II ALICYCLIC COMPOUNDS AND CONFORMATIONAL ANALYSIS: a) Alicyclic compounds: Introduction-nomenclature-preparation: from dihalogen compounds, calcium salts of carboxylic acids, Dieckmann reaction-properties: reactions with halogens, halogen acids, reduction, oxidation, rearrangement reaction- relative stability of cycloalkanes – Bayer's strain theory and its modification. b) Conformational analysis: Definition-differences between conformation and configuration-conformations and stability of ethane, n-butane, 1, 2-dichloroethane, cyclohexane and methyl cyclohexane.

UNIT: III TAUTOMERISM AND MOLECULAR REARRANGEMENTS: a) Tautomerism: Definition-classification of tautomerism-prototropy and anionotropy. A detailed study of i) Keto-enol tautomerism ii) Nitro-acinitro tautomerism. Differences between

tautomerism and resonance-differences between tautomerism and isomerism. b) Molecular Rearrangements: Detailed mechanisms of the following rearrangements: Pinacol-pinacolone, Hofmann, Claisen, Benzidine, Beckmann and Fries rearrangements.

UNIT: IV ALKALOIDS AND TERPENOIDS: a) Alkaloids: Definition- occurence- classification of alkaloids -extraction of alkaloids-general methods of determining the structure of alkaloids- structure and synthesis of the following alkaloids: coniine and nicotine. b) Terpenoids: Definition- occurence- classification- - isolation- isoprene rule- general properties-general methods of determining structure- and structural elucidation of citral and menthol.

UNIT : V MOLECULAR SPECTROSCOPY : a) Ultra violet-visible spectroscopy (Electronic Spectroscopy): Introduction-Franck Condon principle (Electronic transition)-types of transition in organic molecules (n-π*, σ- σ*, n- σ*, π- π*)-basic concepts-batho chromic shift, hypsochromic shift, hyper chromic shift, hypo chromic shift, auxo chrome chromophore, effect of conjucation, Woodward Fieser rules for calculating λ_{max} value-(conjucated dienes, α,β unsaturated carbonyl compounds)**.** b) IR Spectroscopy: Introduction- principle-selection rules-factors influencing vibration frequencies-finger print region-spectral features of some organic compounds (alkane, alkyl residue, alkenes, alkynes, cycloalkanes, halogens, alcohols and carbonyl compounds). c) NMR Spectroscopy: Introduction-rules (predicting the nuclear spin)- chemical shift, factors influencing chemical shift, shielding and deshielding of protons, spin-spin coupling (NMR spectrum of acidified and pure ethanol), coupling constant-rules for calculating the number of lines in NMR spectra (Pascal's triangle)-NMR spectra of ethane, propane, toluene, nitrobenzene, acetone, ethylene, paraxylene.

Books for Study:

1. Arun Bahl and Bahl B.S., (2016) "*A Text Book of Organic Chemistry*", 22nd Edition S.Chand & Company, New Delhi.
2. Finar I.L., (2013) "*Organic Chemistry*" Vol. II, 5th Edition, Pearson Education, New Delhi.
3. Gurdeep R. Chatwal, (2010) "*Organic chemistry of natural products*" Vol- I & II Himalaya publishing house, New Delhi.
4. Sharma Y.R., (2013) "*Elementary Organic Spectroscopy*", S.Chand & Company Pvt. Ltd., New Delhi.
5. Soni P.L. Chawla H.M., (2012) "*Text Book of Organic Chemistry*", Sultan Chand & Sons, New Delhi.

Books for Reference:

1. Finar I.L., (2013) "*Organic Chemistry*," Vol-I, Pearson Education Ltd., Delhi.

2. Tewari T.S., Vishnoi and Mehrotra S.N., (2017) "*A Textbook of Organic Chemistry"*, 2nd Edition, Vikas Publishing House (Pvt.) Ltd., New Delhi.

3. William Kemp, (2000) "*Organic Spectroscopy*" Third Edition, Palgrave, New York.

Web Resources/e-books:

1. https://www.intechopen.com/chapters/76561=
2. https://www.sips.org.in/wp-content/uploads/2024/03/BP301TP-PPT-2.pdf,
3. https://www.ch.ic.ac.uk/local/organic/tutorial/alicyclic1.PDF
4. https://tmv.ac.in/ematerial/chemistry/kpb/SEM_IV_Honours_Rearrangement%20final.pdf
5. https://oms.bdu.ac.in/ec/admin/contents/1_16SCCCH8_2020051904202312.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 enrich the knowledge about chromatography and its types, alicyclic compounds and difference between conformation and configuration, different types of rearrangement, occurrence, extraction and structure of alkaloids and terpenoids, calculation of woodward fisher rule and chemical shift.

Activities to be given: To calculate Woodward fisher rule and chemical shift of organic compounds.

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Discuss the preparation and application of aceto acetic ester. Classify dyes, color and constitution of dyes.	K1 to K3
CLO 2	Determine nomenclature of alicyclic compounds, conformation, configuration, cyclohexane.	K1 to K3
CLO 3	Explain different types of molecular rearrangements and classify tautamerism.	K1 to K4
CLO 4	Classify alkaloids and terpenoids, occurrence, structure and synthesis of conine, nicotine, citral and menthol.	K1 to K3
CLO 5	Discuss the fundamental concept of UV Vis spectroscopy, IR and NMR spectroscopy.	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)

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

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

Unit	Description	Hours	Mode
I	**REACTIVE METHYLENE COMPOUNDS and DYES:** a) Reactive methylene compounds: Introduction- Preparation &synthetic applications of acetoacetic ester & malonic ester. b) Dyes: Introduction to dyes – color and constitution – classification based on structure and application – preparation and applications of the following dyes – methyl orange, congo red, malachite green, phenolphthalein and indigo**.**	12	
II	**ALICYCLIC COMPOUNDS AND CONFORMATIONAL ANALYSIS:** a) Alicyclic compounds: Introduction-nomenclature-preparation: from dihalogen compounds, calcium salts of carboxylic acids, Dieckmann reaction-properties: reactions with halogens, halogen acids, reduction, oxidation, rearrangement reaction- relative stability of cycloalkanes – Bayer's strain theory and its modification. b) Conformational analysis: Definition-differences between conformation and configuration-conformations and stability of ethane, n-butane, 1, 2-dichloroethane, cyclohexane and methyl cyclohexane.	12	Chalk and Talk, PPT, group discussion

III	**MOLECULAR REARRANGEMENTS AND TAUTOMERISM:** a) Molecular Rearrangements: Detailed mechanisms of the following rearrangements: Pinacol-pinacolone, Hofmann, Claisen, Benzidine, Beckmann and Fries rearrangements.b) Tautomerism: Definition-classification of tautomerism- prototropy and anionotropy. A detailed study of i) Keto-enol tautomerism ii) Nitro-acinitro tautomerism Differences between tautomerism and resonance-differences between tautomerism and isomerism.	12	Chalk and Talk, PPT
IV	**ALKALOIDS AND TERPENOIDS:** a) Alkaloids: Definition-occurence- classification of alkaloids -extraction of alkaloids-general methods of determining the structure of alkaloids- structure and synthesis of the following alkaloids: coniine and nicotine. b) Terpenoids: Definition- occurence- classification- - isolation-isoprene rule- general properties-general methods of determining structure- and structural elucidation of citral and menthol.	12	Chalk and Talk, PPT and Virtual Lab.
V	**MOLECULAR SPECTROSCOPY :** a) Ultra violet-visible spectroscopy (Electronic Spectroscopy): Introduction-Franck Condon principle (Electronic transition)-types of transition in organic molecules (n-π^*, σ- σ^*, n- σ^*, π- π^*)-basic concepts-batho chromic shift, hypsochromic shift, hyper chromic shift, hypo chromic shift, auxo chrome chromophore, effect of conjucation, Woodward Fieser rules for calculating λ_{max} value-(conjucated dienes, α,β unsaturated carbonyl compounds)**.** b) IR Spectroscopy: Introduction- principle-selection rules-factors influencing vibration frequencies-finger print region- spectral features of some organic compounds (alkane, alkyl residue, alkenes, alkynes, cycloalkanes, halogens, alcohols and carbonyl compounds). c) NMR Spectroscopy: Introduction-rules (predicting the nuclear spin)- chemical shift, factors influencing chemical shift, shielding and deshielding of protons, spin-spin coupling (NMR spectrum of acidified and pure ethanol), coupling constant-rules for calculating the number of lines in NMR spectra (Pascal's triangle)-NMR spectra of ethane, propane, toluene, nitrobenzene, acetone, ethylene, paraxylene.	12	Chalk and Talk, PPT
	Total Hours	60	

Course Designer: Dr.(Mrs).A.Ramya

Annexure-13

Department of Chemistry					Class: III B.Sc chemistry			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
VI	Core Course	**22OUCH62**	Physical Chemistry- II	4	4	25	75	100
Nature of the Course								
Knowledge and Skill Oriented			Employability Oriented		Entrepreneurship Oriented			
✓								

Course Objectives

1. To acquire the knowledge in rotational, vibrational, IR, Raman spectroscopy
2. To gain the basic concepts in quantum theory
3. To study the laws of photochemistry.
4. To learn the basic concepts in electrochemistry
5. To understand electrodes functions and applications of emf measurements

Course Content:

UNIT: I MOLECULAR SPECTROSCOPY: a) Introduction-characterization of electromagnetic radiation (wavelength, wave number)-regions of the spectrum. b) Rotational spectra of diatomic molecules: Rigid rotator- selection rule –determination of moment of inertia and bond length- relative intensities of spectral lines c)Vibrational-rotational spectroscopy (Infra-red spectroscopy): Introduction-derivation of force constant of diatomic molecule-vibrational energy levels-selection rules-modes of vibration of atoms in poly atomic molecules-CO_2, H_2O(stretching and bending vibrations)-applications, detection of functional group (-OH, -COOH, -NH_2, -CO), study of hydrogen bonding and finger print region d) Raman spectroscopy: Introduction-types of scattering-stokes lines-anti stokes lines-quantum theory of Raman effect-selection rules-advantages of Raman spectroscopy over IR spectroscopy-rule of mutual exclusion-applications (structure of CO_2, H_2O).

UNIT: II QUANTUM CHEMISTRY : Introduction-experimental foundation of quantum theory - black body radiation and planck's theory(no derivation required) –Photoelectric effect and Einstein's theory-Hydrogen atomic spectrum and Bohr's theory of the atom model - dualistic nature of matter –De-Broglies equation-Postulates of quantum mechanics - derivation of Schrodinger wave equation – wave function and its significance-probability of finding electrons-

operators – differential and integral operators only –Application of Schrodinger wave equation – particle in one dimensional box –particle in 3Dbox.

UNIT :III PHOTOCHEMISTRY: Definition of photochemical reaction-differences between thermal and photochemical reactions-laws of photochemistry :Lambert, Beer's law, Grotthus – Draper, Stark-Einstein's law-quantum yield-explanation of low and high quantum yield-experimental determination of quantum yield **-**Jablonski diagram, Non-radiative transition:IC and ISC - radiative transition: Fluorescence and Phosphoresence - differences between fluorescence and phosphorescence - kinetics of photochemical reactions- formation of HCl, HBr - Photosensitization –chemiluminescence and bioluminescence.

UNIT : IV ELECTROCHEMISTRY-I: Electrolytic conductance**-**Faraday's laws of electrolysis – specific conductance – equivalent conductance – molar conductance – variation of molar conductance with dilution – Ionic mobility -Transport number – determination of transport number : Hittrof's method, moving boundary method – Kohlrausch's law – applications – applications of conductance measurements : determination of solubilities of sparingly soluble salts, conductometric titrations - Ostwald's dilution law - Debye - Huckel Onsager theory of strong electrolytes.

UNIT: V ELECTROCHEMISTRY-II : Galvanic Cells –half cell reactions and reversible electrodes –EMF and its measurements- single electrode potential – thermodynamics of reversible electrodes and cells - The Nernst equation – standard electrode potentials: electrochemical series – Types of electrodes- concentration cells: electrode and electrolyte concentration cells – types of concentration cells: concentration cells without and with transference – liquid junction potential - Commercial cells - lead storage and fuel cells- lithium ion battery -applications of emf measurements : acid – base, redox and potentiometric titrations.

Books for Study:

1. Colin N. Banwell & Elaine M. McCash,(2017)"*Fundamentals of Molecular Spectroscopy"*, Tata McGraw-Hill Publishing Company Limited, New Delhi,
2. Puri. B.R, Sharma. L.R. & Pathania. M.S.,(2013)" *Principles of Physical Chemistry*," 46th Edition, Vishal Publishing Company, New Delhi.

Books for Reference:

1. Arun Bahl, Bahl B.S.,Tuli G.D.,(2022)" *Essentials of Physical Chemistry,*" S.Chand & Company Ltd., New Delhi,
2. Gurdeep Chatwal, & Sham K. Anand,(2001) " *Spectroscopy (atomic and molecular)*," Himalaya Publishing House, Mumbai.
3. Rohatgi-Mukherjee K.K.,(2021) "*Fundamentals of Photochemistry*", New Age International Publishers, Daryaganj,.

Web Resources/e-books:

1. **https://www.thevespiary.org/library/Files_Uploaded_by_Users/Enkidu/Chemistry/Fundamentals%20of%20Electrochemistry%20-%20BAGOTSKY%20%282006%29.pdf**
2. **https://application.wiley-vch.de/books/sample/3527324070_c01.pdf**
3. **https://tech.chemistrydocs.com/Books/Physical/Fundamentals-of-Photochemistry-by-K-K-Rohatgi-Mukherjee.pdf**
4. **https://www.uou.ac.in/lecturenotes/science/MSCCH-17/CHEMISTRY%20LN%205%20QUANTUM%20CHEMISTRY-converted.pdf**
5. **http://www.rnlkwc.ac.in/pdf/study-material/chemistry/Spectroscopy.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 identify and understanding different laws of electrochemistry, batteries, concentration cells, Jablonski diagram, fluorescence and phosphorescence, application of Schrodinger wave equation and selection rule & application of Raman spectroscopy.

Activities to be given: To derive Nernst equation and photochemical decomposition reaction of HCl.

Annexure-13

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Discuss the fundamental concept of UV Vis spectroscopy, IR and Raman spectroscopy	K1 to K3
CLO 2	Explain Quantum chemistry for the study of matter in sub-atomic level, Quantum mechanical operators, Schrodinger wave equation and its application to hydrogen & hydrogen like atoms.	K1 to K3
CLO 3	Understand laws of photochemistryt, quantum yield, jablonski diagram, intersystem crossing, energy transfer, sensitizers, decomposition reactions.	K1 to K4
CLO 4	Know the electrolytes, effect of conductance on dilution, Kohlrausch's law, Debye-Huckel-Onsagar's equation, transport numbers. differentiate strong electrolytes and weak electrolytes.	K1 to K3
CLO 5	.Understand Reversible and irreversible cells, electrode potentials, Reference electrode, calculate the EMF of the given cell.	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)

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

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

Annexure-13

LESSON PLAN: TOTAL HOURS (60 Hrs)

Unit	Description	Hours	Mode
I	**MOLECULAR SPECTROSCOPY:** a) Introduction-characterization of electromagnetic radiation (wavelength, wave number)-regions of the spectrum. b) Rotational spectra of diatomic molecules: Rigid rotator- selection rule –determination of moment of inertia and bond length- relative intensities of spectral lines c)Vibrational-rotational spectroscopy (Infra-red spectroscopy): Introduction-derivation of force constant of diatomic molecule-vibrational energy levels-selection rules-modes of vibration of atoms in poly atomic molecules-CO_2, H_2O(stretching and bending vibrations)-applications, detection of functional group (-OH, -COOH, -NH_2, -CO), study of hydrogen bonding and finger print region d) Raman spectroscopy: Introduction-types of scattering-stokes lines-anti stokes lines-quantum theory of Raman effect-selection rules-advantages of Raman spectroscopy over IR spectroscopy-rule of mutual exclusion-applications (structure of CO_2, H_2O).	12	Chalk and Talk, PPT
II	**QUANTUM CHEMISTRY :** Introduction-experimental foundation of quantum theory - black body radiation and planck's theory(no derivation required) –Photoelectric effect and Einstein's theory-Hydrogen atomic spectrum and Bohr's theory of the atom model - dualistic nature of matter –De-Broglies equation-Postulates of quantum mechanics - derivation of Schrodinger wave equation – wave function and its significance-probability of finding electrons-operators – differential and integral operators only –Application of Schrodinger wave equation – particle in one dimensional box – particle in 3Dbox.	12	Chalk and Talk, PPT, group discussion
III	**PHOTOCHEMISTRY:** Definition of photochemical reaction-differences between thermal and photochemical reactions-laws of photochemistry :Lambert, Beer's law, Grotthus –Draper, Stark-Einstein's law-quantum yield-explanation of low and high quantum yield-experimental determination of quantum yield -Jablonski diagram, Non-radiative transition:IC and ISC - radiative transition: Fluorescence and Phosphoresence - differences between fluorescence and phosphorescence - kinetics of photochemical reactions- formation of HCl, HBr - Photosensitization – chemiluminescence and bioluminescence.	12	Chalk and Talk, PPT

IV	**ELECTROCHEMISTRY-I:** Electrolytic conductance-Faraday's laws of electrolysis – specific conductance – equivalent conductance – molar conductance – variation of molar conductance with dilution – Ionic mobility -Transport number – determination of transport number : Hittrof's method, moving boundary method – Kohlrausch's law – applications – applications of conductance measurements : determination of solubilities of sparingly soluble salts, conductometric titrations - Ostwald's dilution law - Debye - Huckel Onsager theory of strong electrolytes.	12	Chalk and Talk, PPT and Seminar
V	**ELECTROCHEMISTRY-II :** Galvanic Cells –half cell reactions and reversible electrodes –EMF and its measurements- single electrode potential – thermodynamics of reversible electrodes and cells - The Nernst equation – standard electrode potentials: electrochemical series – Types of electrodes- concentration cells: electrode and electrolyte concentration cells – types of concentration cells: concentration cells without and with transference – liquid junction potential - Commercial cells - lead storage and fuel cells- lithium ion battery -applications of emf measurements : acid – base, redox and potentiometric titrations.	12	Chalk and Talk, PPT
	Total Hours	60	

Course Designer: Dr.(Mrs).A.Ramya

Annexure-13

Department of Chemistry					Class: III B.Sc chemistry			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
VI	DSEC-II	**22OUCHDSE6A**	Inorganic and Applications of Computer in Chemistry	4	4	25	75	100

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

Course Objectives

1. To learn the fundamentals in coordination compounds and chelates.
2. To understand VBT, CFT and molecular orbital theory.
3. To study metal carbonyls, metal nitrosyls and bioinorganic chemistry.
4. To learn the basics of C-language and its applications in chemistry.
5. To understand the knowledge about chemdraw software.

Course Content:

UNIT: I COORDINATION COMPOUNDS-I: Double salts and coordination compounds – terminology: coordination sphere, coordination number, ligand and its types – nomenclature – EAN rule -Isomerism: structural isomerism and stereo isomerism Chelates: classification – chelate effect and application of the formation of chelated complexes in analytical chemistry.

UNIT: II COORDINATION COMPOUNDS-II: Werner's coordination theory: postulates and experiment evidence - Sidgwick's concept: EAN rule – applications and limitations - Valence Bond Theory: assumptions and illustration to 4- and 6- coordination ions - hybridization and geometry - limitations - Crystal Field Theory: salient features - orbital splitting as applied to octahedral, tetrahedral and square planar complexes - CFSE and its calculation –factors influencing the magnitude of CF splitting: nature of central cation, spectrochemical series- magnetic moments and color of transition metal complexes- Comparison of VBT and CFT - Molecular orbital theory :σ bonding in octahedral complexes $[Co(NH_3)_6]^{3+}$ & $[CoF_6]^{3+}$- π bonding system introduction only.

UNIT: III METAL CARBONYLS, METAL NITROSYLS AND BIO-INORGANIC CHEMISTRY: a) Metal Carbonyls: Definition-classification-general methods of preparation and properties of carbonyls-structure and bonding in $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$, $Mn_2(CO)_9$, and $Co_2(CO)_8$-EAN rule as applied to carbonyls. b) Metal nitrosyls: Nitrosyls-types-nitrosyls compounds. Preparation, properties and structure –sodium nitroprusside-nitroferrous sulphate-EAN as applied to nitrosyls. c) Bio-Inorganic Chemistry: Role of metal ions (Fe, Co, Zn, Mg, Na, Ca &K) in biological systems- structure of metallo porphyrins- structure and functions of heamoglobin, myoglobin.

UNIT: IV PROGRAMMING IN C LANGUAGE: a) Advantages- types of the language-keywords- variables and parameters- arrays- data types-structures- funning of C program constants- operators-expressions- input and output- control statements- looping- functions. b) Applying C programme to Calculation of Inversion temperature-Crms, Cav and Cmp velocity-degrees of freedom on the basis of phase rule- efficiency of a heat engine- half-life period of a

UNIT-V APPLICATIONS OF CHEMDRAW AND CHEM 3D SOFTWARES IN CHEMISTRY: ChemDraw: Introduction- Tool Pallets - Construction of the molecule using ChemDraw tools Analyzing a molecule - Getting the details about the elemental analysis and Mass report - NMR simulation and interpretation - Naming IUPAC - Structure from Name and Name from Structure Chem3D: Model display- Display type- Structure displays- Molecular Surface display - Computational Concepts: - Computational methods: Conformational analysis – geometry Optimizations property (calculations) - Potential energy surface - Molecular Dynamics – Animations - Difference between Chemdraw and Chem 3D.

Books for Study:

1. James E.Huheey., Ellen A., Keiter,Richard L.Keiter, Okhil K.Medhi,(2016) *"Inorganic chemistry principles of structure and reactivity"* 4th edition published by pearson Education, New Delhi,
2. Madan R.D.,(2011) "*Modern Inorganic Chemistry*", S.Chand & Co., New Delhi,
3. B.R. Puri, L.R. Sharma and K.C. Kalia,(2013) "*Principles of Inorganic Chemistry*", 31st Edition, Milestone Publishers and Distributors, New Delhi,
4. Raman K.V., (2004) "*Computers in Chemistry*", Tata McGraw-Hill Publishing Company, New Delhi,

Books for Reference:

1. Balagurusamy,(2019) "*Programming in ANSI C"*, Third Edition, Tata McGraw-Hill Publishing Company,.
2. Chatwal G.R. & Bhagi A.K.,(1996) "*Bio-Inorganic Chemistry*," First Edition, Himalaya Publishing House, Mumbai.
3. Kettle S.F,(1986) "*Coordination Chemistry*", ELBS and Nelson,.
4. Lee J.D.,(2003) "*Concise Inorganic Chemistry*," Fifth Edition, Blackwell Science Ltd., New Delhi,
5. Malik U. Tuli G.D. & Madan R.L. (2004), "*Selected Topics in Inorganic Chemistry*," S.Chand & Company, New Delhi,

Web Resources/e-books:

1. **https://chandand.weebly.com/uploads/9/2/2/7/92278224/_inorganic_chemistry__a_textbook_series__lawrance_g.a.-introduction_to_coordination_chemistry-wiley__2010_.pdf**
2. **https://www2.chemistry.msu.edu/courses/cem151/chap24lect_2019.pdf**
3. **http://repo.upertis.ac.id/1877/1/Bio%20Inorganic%20Chemistry%202.pdf**
4. **https://www-personal.acfr.usyd.edu.au/tbailey/ctext/ctext.pdf**
5. **http://www.acad.bg/ebook/cheminformatics/Leach_An%20Introduction%20to%20Chemoinformatics%20Rev%20Ed.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 identify and understanding the knowledge about naming the coordination compounds, VSEPR, MOT and VBT, Metal nitrosyls and carbonyls, different role of metal ions, structure and function of HB and MB, C programme, 3D molecular structure representation.

Activities to be given: To prepare PowerPoint presentation for nomenclature and EAN rule of coordination compounds.

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Understand the basic concepts of coordinate chemistry, colour and magnetic properties, Isomerism in coordination compounds.	K1 to K3
CLO 2	Explain the Werner's theory and, bonding theories of complex compounds, Calculate EAN rule for coordination compounds.	K1 to K3
CLO 3	Acquire the knowledge on structures of metal carbonyls, EAN and stability of metal carbonyls. Calculation of EAN and its relation with stability of metal carbonyls.	K1 to K4
CLO 4	Identify the types of language, data, keywords, parameters, operators, calculate inversion temperature.	K1 to K3
CLO 5	Understand about Chemdraw and Chem 3D.	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)

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

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

Unit	Description	Hours	Mode
I	**COORDINATION COMPOUNDS-I:** Double salts and coordination compounds – terminology: coordination sphere, coordination number, ligand and its types – nomenclature – EAN rule -Isomerism: structural isomerism and stereo isomerism Chelates: classification – chelate effect and application of the formation of chelated complexes in analytical chemistry.	12	Chalk and Talk, PPT
II	**COORDINATION COMPOUNDS-II:** Werner's coordination theory: postulates and experiment evidence - Sidgwick's concept: EAN rule – applications and limitations - Valence Bond Theory: assumptions and illustration to 4- and 6- coordination ions - hybridization and geometry - limitations - Crystal Field Theory:	12	Chalk and Talk, PPT, group discussion

	salient features - orbital splitting as applied to octahedral, tetrahedral and square planar complexes - CFSE and its calculation –factors influencing the magnitude of CF splitting: nature of central cation, spectrochemical series- magnetic moments and color of transition metal complexes- Comparion of VBT and CFT - Molecular orbital theory :σ bonding in octahedral complexes $[Co(NH_3)_6]^{3+}$ & $[CoF_6]^{3+}$- π bonding system introduction only.		
III	**METAL CARBONYLS, METAL NITROSYLS AND BIO-INORGANIC CHEMISTRY:** a) Metal Carbonyls: Definition-classification-general methods of preparation and properties of carbonyls-structure and bonding in $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$, $Mn_2(CO)_9$, and $Co_2(CO)_8$-EAN rule as applied to carbonyls. b) Metal nitrosyls: Nitrosyls-types-nitrosyls compounds. preparation, properties and structure –sodium nitroprusside-nitroferrous sulphate-EAN as applied to nitrosyls. c) Bio-Inorganic Chemistry: Role of metal ions (Fe, Co, Zn, Mg, Na, Ca &K) in biological systems- structure of metallo porphyrins-structure and functions of heamoglobin, myoglobin.	12	Chalk and Talk, PPT
IV	**PROGRAMMING IN C LANGUAGE:** a) Advantages- types of the language- keywords- variables and parameters- arrays- data types-structures- funning of C program constants- operators-expressions- input and output- control statements- looping-functions. b) Applying C programme to Calculation of Inversion temperature-Crms, Cav and Cmp velocity- degrees of freedom on the basis of phase rule- efficiency of a heat engine- half-life period of a reaction- critical constants-ionic strength of any electrolytic solutions.	12	Chalk and Talk, seminar, PPT and Virtual Lab.
V	**APPLICATIONS OF CHEMDRAW AND CHEM 3D SOFTWARES IN CHEMISTRY**: ChemDraw: Introduction- Tool Pallets - Construction of the molecule using ChemDraw toolsAnalyzing a molecule - Getting the details about the elemental analysis and Mass report - NMR simulation and interpretation - Naming IUPAC - Structure from Name and Name from Structure Chem3D: Model display- Display type- Structure displays- Molecular Surface display - Computational Concepts: - Computational methods: Conformational analysis – geometry Optimizations property (calculations) - Potential energy surface - Molecular Dynamics – Animations - Difference between Chemdraw and Chem 3D	12	Chalk and Talk, PPT
	Total Hours	60	

Course Designer: Dr.(Mrs).A.Ramya

Annexure-13

Department of Chemistry						Class: III B.Sc chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
VI	DSEC -II	22OUCHDSE6B	Diffraction Methods and Applications	4	4	25	75	100

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

Course Objectives:

1. To learn the Diffraction phenomenon, crystallography.
2. To understand particle structure determination and unit cell, space cell.
3. To study structure analysis and semiconductors.
4. To acquire the knowledge in applications of X-ray diffraction.
5. To learn about neutron diffraction and electron diffraction.

Course Content

UNIT : I Diffraction phenomenon – introduction – principles of Diffraction X-rays and crystal-diffraction of particle beams. Single crystal X-rays: X-ray crystallography – single crystals – diffraction from lattices – atoms in lattices – extension of phasing-refinement.

UNIT : II Particle structure determination – Production of X rays – determining the unit cell and space group – intensity data – data reduction – elucidating the structure – crystallographic results.

UNIT :III Structure analysis – Growth of X-ray crystallography – inorganic chemistry and mineralogy – metal complexes and covalent molecule – organometallic compounds – metal and semiconductors – organic compounds – biological structures – single crystals work in perspective.

UNIT : IV Specialized applications of X-ray diffraction – Powder method X-ray diffraction and high polymers degree of crystallinity – orientation – micro and macro structure in polymers – other applications of X-ray diffraction.

UNIT : V Neutron Diffraction – Diffraction of thermal neutron – elastically scattered neutrons – magnetic scattering of neutrons – inelastic neutron scattering – Electron diffraction – Diffraction from gases and vapours – high energy electron diffraction from solids – low energy diffraction.

Books for study:

1. Wormald J., (1973) "*Diffraction Methods*", Oxford series, U.K.
2. Mittemeijer E. J., U. Welzel, (2013)," *Modern Diffraction Methods*," Wiley, New York.

Books for Reference:

1. Ebsworth E.A.V, David W.H., Rankin Stephen Cradock, (1987) "*Structural Methods in Inorganic Chemistry"*, ELBS, Oxford, U.K.
2. Jolly W.L., (1996) "*Modern Inorganic Chemistry*", Mc Graw Hill Book Company New York.

Web resources/E-books:

1. **https://www.slideshare.net/slideshow/diffraction-techniques/240709493**
2. **https://www.doitpoms.ac.uk/tlplib/xray-diffraction/printall.php**
3. **https://serc.carleton.edu/research_education/geochemsheets/techniques/XRD.html**
4. **https://en.wikipedia.org/wiki/Powder_diffraction**
5. **https://www.slideshare.net/slideshow/81347482-xraydiffractiontechnique-39635806/39635806**

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 X Ray crystallography, determine unit crystal and applications of x ray diffraction.

Activities to be given:

1. Power point presentation on X ray diffraction method.

Annexure-13

COURSE LEARNING OUTCOMES (CLO's):

CLOs	Course Learning Outcomes Statements	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Describe X-ray crystallography	K1 to K3
CLO2	Determine unit cell, space group and crystallographic results	K1 to K3
CLO3	Gain the knowledge about structure analysis and x ray crystallography	K1 to K4
CLO4	Explain the application of powder and x ray diffraction method	K1 to K3
CLO5	Differentiate low energy diffraction and high energy diffraction	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	3	2
CLO2	3	3	2	2	3	2
CLO3	3	2	2	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	2	2	2	3

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
I	Diffraction phenomenon – introduction – principles of Diffraction X-rays and crystal-diffraction of particle beams. Single crystal X-rays: X-ray crystallography – single crystals – diffraction from lattices – atoms in lattices – extension of phasing-refinement.	**12**	Chalk and Talk, PPT, and quiz
II	Particle structure determination – Production of X rays – determining the unit cell and space group – intensity data –	**12**	Chalk and Talk, PPT, quiz and You tube Links

	data reduction – elucidating the structure – crystallographic results.		
III	Structure analysis – Growth of X-ray crystallography – inorganic chemistry and mineralogy – metal complexes and covalent molecule – organometallic compounds – metal and semiconductors – organic compounds – biological structures – single crystals work in perspective.	**12**	Chalk and Talk, PPT, quiz, seminar and Virtual Labs
IV	Specialized applications of X-ray diffraction – Powder method X-ray diffraction and high polymers degree of crystallinity – orientation – micro and macro structure in polymers – other applications of X-ray diffraction.	**12**	Chalk and Talk, PPT, quiz and group discussion
V	Neutron Diffraction – Diffraction of thermal neutron – elastically scattered neutrons – magnetic scattering of neutrons – inelastic neutron scattering – Electron diffraction – Diffraction from gases and vapours – high energy electron diffraction from solids – low energy diffraction.	**12**	Chalk and Talk, PPT, quiz, Open book test
	Total Hours	**60**	

Course Designer: Dr.(Mrs).A.Ramya

Annexure-13

Department of Chemistry						Class: III B.Sc chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
V& VI	Core Course lab	**22OUCH61P**	Physical Chemistry Experiments	5	4	40	60	100

Course Objectives:

1.To gain knowledge on the laboratory experiments in order to understand the conceptsof physical changes in chemistry

2. To understand the rates of chemical reactions

3. To acquired knowledge on colligative properties and adsorption isotherm

Course Content:

1. Determination of molecular weights by

a) Transition temperature method: sodium thiosulphate pentahydrate,

b) Cryoscopic method: Rast's macro method- naphthalene

2. Phase diagram involving

a)Simple eutectic and

b)Compound formation

3. Critical solution temperature:

Estimation of sodium chloride by studying the impurity on CST of phenol-water system

4. Thermochemistry:

Heat of solution- Ammonium oxalate & H_2O system

5. Viscosity:

Determination of the composition of an unknown mixture.

6. Kinectics:

Determination of relative strength of acids by acid catalysed hydrolysis of ester

7. Conductometric Titration:

a) Acid-base Titration :HCl Vs NaOH

8. Potentiometric Titration:

Titration between ferrous ammonium sulphate and potassium permanganate

9.Distribution coefficient

Iodine- Carbon tetrachloride, Iodine – Benzene system

10. **Colorimetric titration:**

a) Colorimetric estimation of Nickel. b) Colorimetric estimation of Iron.

11.**pH titration:**

a) Preparation of various Buffer mixtures and comparing their pH values with theoretical values using pH meter.

b) Base pH titration - Strong Acid vs Strong Base c) pH titration - Weak Acid vs Strong Base.

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 Age International: New Delhi,

Web resources / E-books:

1.https://www.vlab.co.in/broad-area-chemical-sciences

2. https://www.gju.edu.jo/sites/default/files/physical_chemistry_lab_manual-2021_1.pdf

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

LESSON PLAN: TOTAL HOURS (120 Hrs)

S.No	Description	Hrs	Mode
1	Introduction	10	Chalk and Talk
2	Experiments	10	Demonstration
3	Transition temperature method: sodium thiosulphate pentahydrate	6	Discussion, Procedure with illustration
4	Cryoscopic method: Rast's macro method- naphthalene	6	Discussion, Procedure with illustration
5	Phase diagram involving a) Simple eutectic	6	Discussion, Procedure with illustration
6	Phase diagram involving b) Compound formation	6	Discussion, Procedure with illustration

7	Estimation of sodium chloride by studying the impurity on CST of phenol-water system	6	Discussion, Procedure with illustration
8	Heat of solution- Ammonium oxalate	6	Discussion, Procedure with illustration
9	Determination of the composition of an unknown mixture	6	Discussion, Procedure with illustration
10	Determination of relative strength of acids by acid catalysed hydrolysis of ester	6	Discussion, Procedure with illustration
11	**Conductometric Titration:** a) Acid-base Titration :HCl Vs NaOH	6	Discussion, Procedure with illustration
12	**Potentiometric Titration**: a) Titration between ferrous ammonium sulphate and potassium permanganate	6	Discussion, Procedure with illustration
13	**Potentiometric Titration**: b) Titration between ferrous ammonium sulphate and potassium dichromate	6	Discussion, Procedure with illustration
	Iodine- Carbon tetrachloride, Iodine – Benzene system	6	
14	**Colorimetric titration:** a) Colorimetric estimation of Nickel.	6	Discussion, Procedure with illustration
15	**Colorimetric titration:** b) Colorimetric estimation of Iron	6	Discussion, Procedure with illustration
16	**pH titration:** a) Preparation of various Buffer mixtures and comparing their pH values with theoretical values using pH meter. b) Base pH titration - Strong Acid vs Strong Base. c) pH titration - Weak Acid vs Strong Base.	6	Discussion, Procedure with illustration
17	Model	10	
	Total	120	

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

2. Ms.K.Punitha

Annexure-13

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 (Major): 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-13

Department of Chemistry						Class: III B.Sc chemistry		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
VI	Core Course lab	**22OUCH62P**	Organic analysis and Estimation	5	4	40	60	100

Course Objectives:

1. To acquire knowledge about analysis of organic compounds
2. To understand basic knowledge about organic estimation

Course Content:

Organic Analysis

Preliminary examination, detection of special elements - nitrogen, sulphur and halogens

Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests, Confirmation of functional groups

- monocarboxylic acid, dicarboxylic acid
- monohydric phenol, polyhydric phenol
- aldehyde, ketone, ester
- carbohydrate (reducing and non-reducing sugars)
- primary, secondary, tertiary amine
- monoamide, diamide, thioamide
- anilide, nitro compound

Preparation of derivatives for functional groups

II. Organic Estimations

1. Estimation of phenol
2. Estimation of aniline
3. Estimation of glycine

Books for Reference:

5. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. (2012), "*Basic Principles of Practical Chemistry*", 2nd ed.; Sultan Chand: New Delhi.
6. Manna, A.K. (2018), "*Practical Organic Chemistry"*, Books and Allied: India.

7. Gurtu, J. N; Kapoor, R. (1987), "*Advanced Experimental Chemistry (Organic)"*, Sultan Chand: New Delh.,
8. Furniss,B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. Vogel's (1989), "*Textbook of Practical Organic Chemistry"*, 5th ed.; Pearson: India,1989

Web resources/E-books:

1.https://www.vlab.co.in/broad-area-chemical-sciences

2. https://www.vedantu.com/jee-main/chemistry-qualitative-analysis-of-organic-compounds

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

S.No	Description	Hrs	Mode
1	Detection of special elements, Aromatic and aliphatic nature, Test for saturation and unsaturation and identification of functional groups	8	Demonstration
2	Derivative preparation	6	Demonstration
3	Analysis of organic substance -I	5	Discussion, Procedure with illustration
4	Analysis of organic substance -II	5	Discussion, Procedure with illustration
5	Analysis of organic substance -III	5	Discussion, Procedure with illustration
6	Analysis of organic substance –IV	5	Discussion, Procedure with illustration
7	Analysis of organic substance -V	5	Discussion, Procedure with illustration
8	Analysis of organic substance -VI	5	Discussion, Procedure with illustration
9	Estimation of phenol	4	Discussion, Procedure with illustration
10	Estimation of aniline	4	Discussion, Procedure with illustration
11	Estimation of glycine	4	
12	Model	4	
	Total	60	

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

2. Dr.(Mrs).A.Ramya

Annexure-13

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 and Estimation	10
2	Procedure for organic analysis and estimation	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	15
2	Experiment- Organic estimation	15
2	Procedure for organic analysis and estimation	10
3.	Viva	10
4.	Record note	10
	Total	**60**

Distribution of marks for Estimation

Estimation -15 marks
Error <3% - 15 marks
Error 3-4% - 10 marks
Error > 4% - 7 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.

Department of Chemistry					Class: III B.Sc chemistry			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
VI	Skill Enhancement Course	**22OUCHSE6**	Green and nanochemistry	2	2	25	75	100

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

Course Objectives

1. To learn the need for green chemistry and the concept of atom economy.
2. To gain knowledge in various types of green solvents, concepts in designing a green synthesis.
3. To study microwave, ultrasound assisted reactions in green chemistry.
4. To understand the origin of nanotechnology, synthesis of nanomaterials.
5. To study the applications of nanomaterials in nanomedicine.

Course Content:

UNIT I: GREEN CHEMISTRY-I: Need for Green chemistry-Goals of Green chemistry-Limitations/Obstacles-The progress of Green chemistry-Twelve principles of Green chemistry-Concept of Atom economy (Rearrangement reactions, Addition reactions, Substitution reactions and Elimination reactions)-Concept of selectivity (Chemoselectivity, Regioselectivity, Enantioselectivity and Diastereoselectivity)

UNIT II: GREEN CHEMISTRY-II: Green solvents-Definition- Various types of Green solvents (Supercritical carbon dioxide, Ionic liquids, water and organic synthesis in solid state) -Mode of supplying energy to a reaction (Use of microwaves and Use of sonication)-Basic concepts in designing a Green synthesis (Choice of starting materials, reagents, catalysts and solvents). Synthesis of Adipic acid, Catechol, Methyl methacrylate, Urethane, Benzyl bromide, Acetaldehyde, Citral, Furfural and Paracetamol.

UNIT III: GREEN CHEMISTRY-III: Microwave assisted reactions in water (Hydrolysis of benzyl chloride, Hydrolysis of benzamide, Hydrolysis of methylbenzoate, Oxidation of toluene , Oxidation of alcohols) - Microwave assisted reactions in Organic solvents (Esterification, Fries

rearrangement, Diels Alder reaction)-Microwave assisted solvent-free reactions (Deprotection, Saponification, Synthesis of Benzimidazoles)-Ultrasound assisted reactions (Esterification, Saponification, Oxidations, Coupling reactions)- Future trends in Green Chemistry.

UNIT IV : NANOCHEMISTRY: a) Definition of nanosized material – origin of nano technology - difference in properties between bulk and nanomaterials - Dimension based classification of nano materials - 0D, 1D, 2D, 3D b) Properties and synthesis of nano materials :Magnetic and electrical properties of nanomaterials - synthesis of nano materials - basics of bottom-up and top down approach - PVD, CVD, Sol-gel, wet chemical synthesis only.

UNIT V: APPLICATIONS OF NANO TECHNOLOGY: Quantum dots - fabrication - applications - CNT - synthesis and applications - application of nano materials in nano medicines and pollution control - Principle of Scanning electron microscope.

Books for study:

4. Das Asim K., Mauha Das.,(2018), "*An Introduction to Nanomaterials and Nanoscience*", CBS Publishers & Distributors Pvt Ltd., New Delhi.
5. Kumar V.,(2007), "*An Introduction to Green Chemistry*", First Edition, Vishal Publishing Co., New Delhi,
6. Shanmugam S., (2011),"*Nanotechnology*", MJP publishers, Chennai.

Books for Reference:

1. Ahulwalia V.K. Kidwai M.,(2012), "*New Trends in Green Chemistry*", Second Edition, Anamaya Publishers, New Delhi.
2. Kenneth & Klabunde J,(2001), "*Nanoscale Materials in Chemistry*", Wiley Interscience, New York.
3. Ownes F.J.(2003),"*Introduction to Nanotechnology*", Wiley publication, USA.

Web Resources/e-books:

1. **https://chandand.weebly.com/uploads/9/2/2/7/92278224/_inorganic_chemistry__a_textbook_series__lawrance_g.a.-introduction_to_coordination_chemistry-wiley__2010_.pdf**
2. **https://www2.chemistry.msu.edu/courses/cem151/chap24lect_2019.pdf**
3. **http://repo.upertis.ac.id/1877/1/Bio%20Inorganic%20Chemistry%202.pdf**
4. **https://www-personal.acfr.usyd.edu.au/tbailey/ctext/ctext.pdf**
5. **http://www.acad.bg/ebook/cheminformatics/Leach_An%20Introduction%20to%20Chemoinformatics%20Rev%20Ed.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 identify and understanding the knowledge about Green chemistry, Microwave assisted reactions in Organic, nanomaterials and application of nano material.

Activities to be given: To prepare power point presentation on twelve principles of Green chemistry.

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Understand the Concept of Atom economy	K1 to K3
CLO 2	Explain the Mode of supplying energy to a reaction	K1 to K3
CLO 3	Discuss the Microwave assisted reactions in Organic solvents (Esterification, Fries rearrangement, Diels Alder reaction)-Microwave assisted solvent-free reactions	K1 to K3
CLO 4	Identify the Properties and synthesis of nano materials :Magnetic and electrical properties of nanomaterials	K1 to K3
CLO 5	Understand synthesis and applications - application of nano materials in nano medicines and pollution control.	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-13

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

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

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

LESSON PLAN: TOTAL HOURS (30 Hrs)

Unit	Description	Hours	Mode
I	**UNIT: I GREEN CHEMISTRY-I:** Need for Green chemistry-Goals of Green chemistry-Limitations/Obstacles-The progress of Green chemistry-Twelve principles of Green chemistry-Concept of Atom economy (Rearrangement reactions, Addition reactions, Substitution reactions and Elimination reactions)-Concept of selectivity (Chemoselectivity, Regioselectivity, Enantioselectivity and Diastereoselectivity)	6	Chalk and Talk, PPT
II	**UNIT II: GREEN CHEMISTRY-II:** Green solvents-Definition-Various types of Green solvents (Supercritical carbon dioxide, Ionic liquids, water and organic synthesis in solid state) -Mode of supplying energy to a reaction (Use of microwaves and Use of sonication)-Basic concepts in designing a Green synthesis (Choice of starting materials, reagents, catalysts and solvents). Synthesis of Adipic acid, Catechol, Methyl methacrylate, Urethane, Benzyl bromide, Acetaldehyde, Citral, Furfural and Paracetamol.	6	Chalk and Talk, PPT, group discussion

III	**UNIT III: GREEN CHEMISTRY-III:** Microwave assisted reactions in water (Hydrolysis of benzyl chloride, Hydrolysis of benzamide, Hydrolysis of methylbenzoate, Oxidation of toluene , Oxidation of alcohols) - Microwave assisted reactions in Organic solvents (Esterification, Fries rearrangement, Diels Alder reaction)- Microwave assisted solvent-free reactions (Deprotection, Saponification, Synthesis of Benzimidazoles)-Ultrasound assisted reactions (Esterification, Saponification, Oxidations, Coupling reactions)- Future trends in Green Chemistry.	6	Chalk and Talk, PPT
IV	**UNIT IV : NANOCHEMISTRY:** a) Definition of nanosized material – origin of nano technology - difference in properties between bulk and nanomaterials - Dimension based classification of nano materials - 0D, 1D, 2D, 3D b) Properties and synthesis of nano materials :Magnetic and electrical properties of nanomaterials - synthesis of nano materials - basics of bottom-up and top down approach - PVD, CVD, Sol-gel, wet chemical synthesis only.	6	Chalk and Talk, seminar, PPT and Virtual Lab.
V	**UNIT V: APPLICATIONS OF NANO TECHNOLOGY:** Quantum dots - fabrication - applications - CNT - synthesis and applications - application of nano materials in nano medicines and pollution control - Principle of Scanning electron microscope.	6	Chalk and Talk, PPT
	Total Hours	30	

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

Annexure-13

Department of Chemistry						Class: III B.Sc(N& D)		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
V	Generic elective course	**22OUNDGECH5**	Applied Chemistry	4	4	25	75	100

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

Course Objectives:

1. To enable students to understand the fundamental concepts in Water analysis
2. To understand about polymer chemistry
3. To learn manufacturing techniques behind match Industrial products.
4. To study about petrochemicals, paints and lacquers
5. To acquire knowledge on agricultural chemistry

Course Content:

UNIT: I WATER TREATMENT: Chemical (Calcium. Magnesium, Iron, Sulphide, Cyanide, Chlorine demand, Fluoride, Arsenic and Cadmium) and Physical (colour, turbidity, odour, taste, temperature, pH, electrical conductivity, solids, dissolved solids, acidity, TDS, alkalinity) Analysis of water quality parameters – Standard prescribed for water quality by WHO and other Indian Standards – Sea Water as a source of drinking water – Electro dialysis method and Reverse osmosis method for purification of water.

UNIT: II POLYMER CHEMISTRY: a) Rubber: Natural and Synthetic rubbers – Composition of natural rubber, Neoprene, Styrene – Butadiene rubber (SBR). b) Polymer chemistry: Addition and Condensation polymerization –Copolymer – Homopolymer – Definition of natural and synthetic fibres – natural and synthetic resins – Bakelite and Nylon-66.

UNIT: III INDUSTRIAL CHEMISTRY-I: a) Match Industry: Pyrotechnics and explosives – Raw material needed for match industry – Manufacturing process – pyrotechniques –Colored smokes. b) Silicate Industry: Cement and Glass, Raw materials and manufacture of cement and Glass.

UNIT: IV INDUSTRIAL CHEMISTRY-II: a) Petrochemicals: Elementary study – Definition-Origin-Composition-Chemicals from natural gas, Petroleum, Light Naphtha and Kerosene. b) Paints and Lacquers: Pigments-Paints-Ingredients in Paints-Manufacture-Lacquers-Varnishes.

UNIT: V AGRICULTURAL CHEMISTRY: Fertilizers: Definition-nutrients for plants-role of various elements in plants Growth-natural and chemical fertilizers-classification of chemical fertilizers-Urea and potassium nitrate-Mixed fertilizer

Books for study:

1.Arora M.G. & Singh M.,(2002) "*Industrial Chemistry*" Anmol Publications. Pvt Ltd, New Delhi,

2. Bagavathi Sundari. K., (2006)"*Applied Chemistry*", MJP Publishers, Chennai,.

3. Chakravarthy B.N,(1998) "*Industrial Chemistry*" Oxford & IBH Publishing & Co. Pvt Ltd., New Delhi,

Book for Reference:

1. Jain and Monika Jain, (1990) "*Engineering Chemistry*", Fifth Edition, Dhanpat Rai & Sons, Delhi,

2. Mahapatra G.,(2001) "*Elements of Industrial Chemistry*", Kalyani Publishers, New Delhi,

3. Sharma B.K.,(1999) "*Industrial Chemistry*", Tenth Edition, Krishna Prakashan Media (Pvt.) Ltd., Meerut,

Web resources/E-books:

1. **https://en.wikipedia.org/wiki/Water_treatment**
2. **https://www.youtube.com/watch?v=dXaBkrS1HaM**
3. **https://www.fao.org/4/x5860e/x5860e05.htm**
4. **https://en.wikipedia.org/wiki/Naphtha**
5. **https://www.vedantu.com/chemistry/agriculturachemistry#:~:text=Agricultural%20chemistry%20is%20a%20science,improve%20fertility%20and%20increase%20yield.**

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 water treatment, polymer chemistry, industrial products and agricultural products.

Activities to be given:

1. Power point presentation on the role of various elements present in plant growth
2. To find out the composition of match stick

COURSE LEARNING OUTCOMES (CLO's):

CLOs	Course Learning Outcomes Statements	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Explain Electro dialysis method and Reverse osmosis method for purification of water.	K1 to K3
CLO2	Classify the polymers	K1 to K3
CLO3	Illustrate the manufacturing process of cement and glass	K1 to K4
CLO4	Discuss about various Ingredients in Paints and varnishes	K1 to K3
CLO5	Describe about various fertilizer	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	3	2
CLO2	3	3	2	2	3	2
CLO3	3	2	2	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	2	2	2	3

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

Annexure-13

LESSON PLAN: TOTAL HOURS (60 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
I	water treatment: chemical and physical analysis of water quality parameters – standard prescribed for water quality by who and other indian standards – sea water as a source of drinking water – electro dialysis method and reverse osmosis method for purification of water.	12	Chalk and Talk, PPT, and quiz
II	POLYMER CHEMISTRY: a) Rubber: Natural and Synthetic rubbers – Composition of natural rubber, Neoprene, Styrene – Butadiene rubber (SBR).b) Polymer chemistry: Addition and Condensation polymerization –Copolymer – Homopolymer – Definition of natural and synthetic fibres – natural and synthetic resins – Bakelite and Nylon-66.	12	Chalk and Talk, PPT, quiz and You tube Links
III	INDUSTRIAL CHEMISTRY-I: a) Match Industry : Pyrotechnics and explosives – Raw material needed for match industry – Manufacturing process – pyrotechniques –Colored smokes. b)Silicate Industry: Cement and Glass, Raw materials and manufacture of cement and Glass.	12	Chalk and Talk, PPT, quiz, seminar and Virtual Labs
IV	INDUSTRIAL CHEMISTRY-II: a) Petrochemicals : Elementary study –Definition-Origin-Composition-Chemicals from natural gas, Petroleum, Light Naphtha and Kerosene. b) Paints and Lacquers: Pigments-Paints-Ingredients in Paints-Manufacture-Lacquers-Varnishes.	12	Chalk and Talk, PPT, quiz and group discussion
V	AGRICULTURAL CHEMISTRY:Fertilizers: Definition-nutrients for plants-role of various elements in plants Growth-natural and chemical fertilizers-classification of chemical fertilizers-Urea and potassium nitrate-Mixed fertilizer	12	Chalk and Talk, PPT, quiz, Open book test
	Total Hours	60	

Course Designer: Mrs.K.Punitha

Annexure-13

Department of Chemistry						Class: III B.Sc(N& D)		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
VI	Generic elective course	22OUNDGECH6	Applied and Medicinal Chemistry	4	4	25	75	100

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

Course Objectives:

1. To enable students to understand the fundamental concepts in Soap
2. To understand about plastics and paper industry
3. To learn manufacturing techniques behind leather technology
4. To study about anaesthetics, analgesics and antipyretics
5. To acquire the knowledge on sulpha drugs and antibiotics

Course Content:

UNIT: I SOAP AND DETERGENTS: Soap: Saponification –Definition- Types of soap- Manufacture of soap: Hot process, Cold process and Modern continuous process- Cleansing action of soap. Detergent: Definition- Classification with example- Distinction between soaps and detergents.

UNIT: II PLASTICS AND PAPER INDUSTRY: a) Plastics: Introduction-characteristics of plastics-classification of plastics- differences between thermo setting and thermo plastics- preparation and applications of bakelite, polythene, PVC, polypropylene, poly styrene and urea formaldehyde resin. Differences between plastics and resins. b) Paper industry: Introduction- raw materials and manufacturing process of paper- types of paper-paper industry in India

UNIT: III LEATHER TECHNOLOGY: Preservation and processing of leather: Chemical methods of curing and preservation of hides and skins in acid & alkaline solutions-principles of methods employed in curing, liming, deliming, bating and pickling –process of dyeing leather-use of mordants-dyeing auxilliaries such as leveling,wetting and dispersing agents- dye fixations.

UNIT: IV ANAESTHETICS, ANALGESICS AND ANTIPYRETICS: a) Anaesthetics: Definition- classification- applications of nitrousoxide and chloroform. b) Analgesics: Definition-mode of action-specific applications of antipyrine and aspirin. c) Antipyretics: Definition-mode of action- medicinal uses of salol and paracetamol.

UNIT: V SULPHA DRUGS AND ANTIBIOTICS

a)Sulpha drugs: Definition-mode of action-applications of sulphanilamide and sulphapyridine. **b)** Antibiotics: Definition- characteristics- mode of action- structure and uses of the following antibiotics- penicillins and tetracyclins**.**

Books for study:

1.. Ashotosh Kaur, (2006) "*Medicinal Chemistry*", 3rd Edition, New Age International (Pvt) Limited, New Delhi.

2. Madan R.D., (2004) "*Modern Inorganic Chemistry*", S.Chand & Co., New Delhi.

3. Puri P.R. Sharma L.R. & Kalia K.C., (2008) "*Principles of Inorganic Chemistry*", Milestone Publishers, Delhi.

4. Wahid U. Malik G.D. Tuli & Madan R.D., (2002) "*Selected Topics in Inorganic Chemistry*", S.Chand & Co, New Delhi.

Book for Reference:

1. James Huheey E. Ellen A. & Keiter, (2013) "*Inorganic Chemistry*", 4th Edition, Pearson Education, New Delhi.

2. Kadam S., (2006) "*Principles of Medicinal Chemistry*", Nirali Prakashan, New Delhi.

3. Lee J. D., (2003) "*Concise Inorganic Chemistry*", Fifth Edition, Blackwell Science, USA.

4. Madan R.L. & Tuli G.D., (2001) "*Simplified Course in Inorganic Chemistry*" S.Chand &Co., New Delhi.

Web resources/E-books:

1. **https://www.vedantu.com/chemistry/soaps-and-detergents**
2. **https://www.swiftpak.co.uk/insights/plastic-vs-paper-packaging-the-pros-and-cons**
3. **https://hbtu.ac.in/readWriteData/Department/21/BOS_LT_PDF.pdf**
4. **https://pubs.asahq.org/anesthesiology/article/32/6/493/20695/ANTIPYRETIC-ANALGESIC-DRUGS**
5. **https://www.everydayhealth.com/sulfonamides/**

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 Soap plastics and paper industry, leather technology, anaesthetics, analgesics and antipyretics and sulpha drugs and antibiotics**.**

Activities to be given:

1. Prepare soaps by cold process
2. Power point presentation on paper industry

COURSE LEARNING OUTCOMES (CLO's):

CLOs	Course Learning Outcomes Statements	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Explain the Types of soap Manufacture of soap Hot process, Cold process and Modern continuous process	K1 to K3
CLO2	Classify the plastics	K1 to K3
CLO3	Illustrate Chemical methods of curing and preservation of hides and skins in acid & alkaline	K1 to K4
CLO4	Discuss about Anaesthetics: Definition- classification- applications of nitrousoxide and chloroform	K1 to K3
CLO5	Describe about Sulpha drugs	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-13

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	3	2
CLO2	3	3	2	2	3	2
CLO3	3	2	2	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	2	2	2	3

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
I	SOAP AND DETERGENTS: Soap: Saponification – Definition- Types of soap- Manufacture of soap: Hot process, Cold process and Modern continuous process- Cleansing action of soap. Detergent: Definition- Classification with example- Distinction between soaps and detergents.	**12**	Chalk and Talk, PPT, and quiz
II	PLASTICS AND PAPER INDUSTRY: a) Plastics: Introduction-characteristics of plastics-classification of plastics- differences between thermo setting and thermo plastics- preparation and applications of bakelite, polythene, PVC, polypropylene, poly styrene and urea formaldehyde resin. Differences between plastics and resins. b) Paper industry: Introduction- raw materials and manufacturing process of paper- types of paper-paper industry in India.	**12**	Chalk and Talk, PPT, quiz and You tube Links
III	LEATHER TECHNOLOGY: Preservation and processing of leather : Chemical methods of curing and preservation of hides and skins in acid & alkaline solutions-principles of methods employed in curing, liming, deliming, bating and pickling –process of dyeing leather-use of mordants-dyeing auxilliaries such as leveling,wetting and dispersing agents- dye fixations.	**12**	Chalk and Talk, PPT, quiz, seminar and Virtual Labs
IV	ANAESTHETICS, ANALGESICS AND ANTIPYRETICS:a)Anaesthetics: Definition- classification-applications of nitrousoxide and chloroform. b)Analgesics: Definition-mode of action-specific applications of antipyrine and aspirin. c)Antipyretics: Definition-mode of action- medicinal uses of salol and paracetamol.	**12**	Chalk and Talk, PPT, quiz and group discussion
V	SULPHA DRUGS AND ANTIBIOTICS a)Sulpha drugs: Definition-mode of action-applications of sulphanilamide and sulphapyridine. **b)** Antibiotics: Definition- characteristics- mode of action- structure and uses of the following antibiotics- penicillins and tetracyclins.	**12**	Chalk and Talk, PPT, quiz, Open book test
	Total Hours	**60**	

Course Designer: Mrs. K.Punitha

Annexure-13

Department of Chemistry					Class: III B.Sc-Physics			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
V	Generic Elective Course	22OUPHGECH5	Inorganic, Physical and Medicinal Chemistry	4	4	25	75	100
Nature of the Course								
Knowledge and Skill Oriented			Employability Oriented		Entrepreneurship Oriented			
✓								

Course Objectives:

1.To gain and understand different types of elements presents in periodic tables.

2. To understand different types of bonds formed by the atoms.

3. To learn about classification, preparation, properties of colloidal.

4. To gain knowledge of chemical kinetics

5. To enrich the knowledge in medicinal Chemistry.

Course Content:

UNIT: I PERIODIC TABLE & PERIODIC PROPERTIES: a) Long form of periodic table-classification of elements into s, p, d and f blocks. b) Atomic radii, ionic radii, ionization potential, electro affinity, electro negativity and their periodic variations- factors affecting ionization potential and electro negativity - metallic and non-metallic character.

UNIT : II CHEMICAL BONDING: Introduction-octet rule and its limitations-types of bonds-Covalent bond - Ionic bond –factors forming the formation of ionic bonds-- difference between covalent and ionic bonds - Fajans' rule – coordinate covalent bond - VSEPR theory - Valence bond theory- limitations of VBT - hybridisation – sp ($BeCl_2$), sp^2 (BCl_3) and sp^3(CH_4). Molecular orbital theory: Bonding and antibonding molecular orbitals. MO diagram or molecules like H_2, He_2, O_2, N_2, CO. Comparison between VBT and MOT.

UNIT: III COLLOIDAL STATE: Introduction: Phases of colloids-classification of colloidal solutions- preparation (Dispersion methods only). properties- colligative property- optical property-Tyndal effect, Kinetic property- Brownian movement; Electrical properties-Electrical

double layer and, Electrophoresis-Purification of colloidal solution –dialysis. Applications of colloids: Food, colloidal medicine, rubber plating, sewage disposal, clarification of water, detergent action of soap, artificial rain.

UNIT: IV CHEMICAL KINETICS: Introduction – rate of reaction – rate law and rate constant – order and molecularity – first order reactions – examples – rate equation – derivation – half-life period - second order reactions - examples – rate equations – derivation - zero order and third order reactions - examples – rate equations (no derivation required) - determination of order of a reaction. Influence of temperature on the rate of reaction – Arrhenius rate equation and its significance – theory of reaction rates –Lindemann theory of unimolecular reaction – Theory of absolute reaction rate.

UNIT: V MEDICINALCHEMISTRY: Chemotherapy: Introduction a) Anesthetics: Definition-classification with examples. b) Analgesics: Definition- classification with examples. c) Antibiotics-Definition-uses of penicillin, streptomycin, tetracycline and chloramphenicol. d) Antimalarial Drugs-Definition- mode of action- examples.

Text Books:

1. Puri P.R. Sharma L.R. & Kalia K.C., (2019) "*Principles of Inorganic Chemistry*",Milestone Publishers, Delhi.
2. Bahl B.S. Tuli G.D. & Arun Bahl, (2010) " *Essentials of Physical Chemistry,"* S.Chand & Company Ltd., New Delhi.
3. Ashotosh Kaur, (2006) "*Medicinal Chemistry*", 3rd Edition, New Age International (Pvt) Limited, New Delhi.
4. Madan R. D, (2011) "*Modern Inorganic Chemistry*", S. Chand and Company Ltd, New Delhi.

Reference Books:

1. Malik, Wahid U, Madan R.d. & Tuli G.D., (2010) "*Selected Topics in Inorganic Chemistry*" S.Chand &Co., New Delhi.
2. Bagavathi Sundari. K., (2006) "*Applied Chemistry*", MJP Publishers, Chennai.
3.Soni P.L.,Dharmarha O.P. & Dash U.N., (2009) "*Text Book of Physical Chemistry*", Sultan & Sons, New Delhi.
4.Bhalerao Marry & Giragon, (2018) "*Pharmaceutical Chemistry*", Himalaya Publishing House, Ramdoot.
5.Puri, Sharma and Pathania, (2011) "*Principles of Physical Chemistry*," Vishal Publishing Co, Jalandhar.

Web Resources/e-books:

1.https://www.britannica.com/science/periodic-table/Periodicity-of-properties-of-the-elements

2. https://ncert.nic.in/textbook/pdf/kech104.pdf

3. https://homework.study.com/explanation/what-is-a-colloidal-state.html

4. https://ncert.nic.in/ncerts/l/lech104.pdf

5. https://www.pharm.ox.ac.uk/research/themes-1/medical-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 enrich the understanding capacity on periodic tables, bonds formed by the atoms, colloidal, chemical kinetics and medicinal Chemistry.

Activities to be given:

1. Power point presentation on electronic configuration of elements in periodic table.

2.To collect information about the composition of the drugs.

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	Outline long form of periodic table-classification of elements into s, p, d and f blocks.	K1 to K3
CLO 2	Discuss the types of bonds-Covalent bond - Ionic bond factors forming the formation of ionic bonds--	K1 to K3
CLO 3	Examine the classification of colloidal solutions-	K1 to K4
CLO 4	Derive first and second order rate constant	K1 to K3
CLO 5	Demonstrate the mode of action of antimalarial drugs	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-13

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

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

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
I	UNIT: I PERIODIC TABLE & PERIODIC PROPERTIES: a) Long form of periodic table-classification of elements into s, p, d and f blocks. b) Atomic radii, ionic radii, ionization potential, electron affinity, electro negativity and their periodic variations.	**12**	Chalk and Talk, PPT, and quiz
II	UNIT : II CHEMICAL BONDING: Introduction-octet rule and its limitations-types of bonds-Covalent bond - Ionic bond –factors forming the formation of ionic bonds--difference between covalent and ionic bonds - Fajans' rule – coordinate covalent bond - VSEPR theory - Valence bond theory- limitations of VBT - hybridisation – sp ($BeCl_2$), sp^2 (BCl_3) and sp^3(CH_4). Molecular orbital theory: Bonding and antibonding molecular orbitals. MO diagram or molecules like H_2, He_2, O_2, N_2, CO. Comparison between VBT and MOT.	**12**	Chalk and Talk, PPT, quiz and You tube Links
III	UNIT: III COLLOIDAL STATE: Introduction: Phases of colloids-classification of colloidal solutions- preparation (Dispersion methods only). properties- colligative property-optical property-Tyndal effect, Kinetic property- Brownian movement; Electrical properties-Electrical double layer and, Electrophoresis-Purification of colloidal solution – dialysis. Applications of colloids: Food, colloidal medicine, rubber plating, sewage disposal, clarification of water, detergent action of soap, artificial rain	**12**	Chalk and Talk, PPT, quiz, seminar and Virtual Labs
IV	UNIT: IV CHEMICAL KINETICS**:** Introduction – rate of reaction – rate law and rate constant – order and molecularity – first order reactions – examples – rate equation – derivation – half life period - second order reactions - examples – rate	**12**	Chalk and Talk, PPT, quiz and group discussion

	equations – derivation - zero order and third order reactions - examples – rate equations (no derivation required) - determination of order of a reaction. Influence of temperature on the rate of reaction – Arrhenius rate equation and its significance – theory of reaction rates –Lindemann theory of unimolecular reaction – Theory of absolute reaction rate.		
V	UNIT: V MEDICINALCHEMISTRY: Chemotherapy: Introduction a) Anesthetics: Definition-classification with examples. b) Analgesics: Definition- classification with examples. c) Antibiotics- Definition-uses of penicillin, streptomycin, tetracycline and chloramphenicol. d) Antimalarial Drugs-Definition- mode of action- examples.	**12**	Chalk and Talk, PPT, quiz, Open book test
	Total Hours	**60**	

Course Designer: Mrs.K.Punitha

Annexure-13

Department of Chemistry					Class: III B.Sc physics			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/ Week**	**CIA**	**SE**	**Total**
VI	Generic Elective course	22OUPHGECH6	Analytical and Inorganic Chemistry	4	4	25	75	100
Nature of the Course								
Knowledge and Skill Oriented			Employability Oriented		Entrepreneurship Oriented			
✓								

Course Objectives:

1. To acquire knowledge on volumetric method of analysis.
2. To learn about chromatography and colorimetric analysis.
3. To gain the knowledge of metals, ores- occurrence and extraction process.
4. To study the concept of stability of nucleus, radioactive law and different types of particles &its applications.
5. To gain about fundamental concepts of acid base titration and oxidation reduction reactions.

UNIT: I ANALYTICAL CHEMISTRY-I: a) Volumetric methods of analysis: Introduction- principle- terminology: molality, molarity, normality, mole fraction -titration- end point- indicator - types of indicators - Standard solution- types of standard solution- requirements of primary standard solution. b) Acid-base titration: Types- titration curves and choice of indicators- Ostwald's theory-theory of acid- base indicators. c) Redox titration: Definition with examples- theory of redox indicators (Action of Phenolphthalein and methyl orange).

UNIT: II ANALYTICAL CHEMISTRY- II: a) Chromatography: Definition- principle of chromatography- types of chromatography- experimental techniques and applications of column chromatography- thin layer chromatography and paper chromatography- R_f value and factors affecting R_f value**.** b) Colorimetric method of analysis: Introduction- principle- Beer- Lambert's law- criteria for satisfactory colorimetric estimations- Duboscq colorimeter- estimation of Fe^{3+} ion

UNIT : III PRINCIPLES AND PROCESS OF METALLURGY: a) Ores and minerals: Definition-examples -various steps of metallurgy-crushing, pulverizing concentration of the ore-calcination and roasting- reduction into metals (Alumino-thermic process). b) Refining of metals: Electrolytic refining, Zone refining and Van-Arkel process.

UNIT : IV NUCLEAR CHEMISTRY: a) Composition of the nucleus -nuclear forces-mass defect-binding energy-nuclear stability. b) Soddy's group displacement law-illustration-law of radioactive disintegration. c) Nuclear fission: Definition-theories of fusion-application of fission-the principle of atom bomb. d) Nuclear fusion: Definition-emission of energy-stellar energy-hydrogen bomb. e) Application of radioactivity-In medicine, agriculture, industry and analytical fields-carbon dating.

UNIT : V ACIDS, BASES AND OXIDATION AND REDUCTION: a) Modern concepts of acids and bases: Arrhenius, Bronsted- Lowry, Lewis and Lux-Flood; Relative strengths of acids and bases – amphoteric solvents- levelling effects. b) Hard and soft acids and bases: Pearson's concept –HSAB principle and its applications. c) Oxidation and Reduction: Definitions- oxidation number-differences between oxidation number and valency- rules for calculating oxidation number- solved examples- oxidizing and reducing agents- redox reactions-balancing of redox equations by oxidation number method.

Books for study:

1. Gopalan R. Subramanian P.S. & Rengarajan K., (2010) "*Elements of Analytical Chemistry*", S. Chand & Sons New Delhi.
2. Madan R.D., (2011) "*Modern Inorganic Chemistry*", S.Chand & Co., New Delhi.
3. Puri P.R. Sharma L.R. & Kalia K.C., (2017) "*Principles of Inorganic Chemistry*", Vishal Publications, Jalandhar.

Books for Reference:

1. James Huheey E. Ellen A. & Keiter, (2013) "*Inorganic Chemistry*", 4th Edition, Pearson Education, New Delhi.
2. Khopkar S.M., (2012) "*Basic Concepts of Analytical Chemistry*", New Age International Pvt. Ltd., New Delhi.
3. Lee J. D., (2016) "*Concise Inorganic Chemistry*", 5th Edition, Blackwell Science,USA.

4. Skoog, Douglas.A, West Donald.M, Crough, Stanley.R., (2014) "*Fundamentals of Analytical Chemistry*",Cengage Learning, New Delhi.

5. Wahid U. Malik G.D. Tuli & Madan R.D., (2014) "*Selected Topics in Inorganic Chemistry*", S.Chand & Co, New Delhi.

Web Resources/e-books:

1. **https://www.britannica.com/science/volumetric-analysis**
2. https://www.thermofisher.com/blog/ask-a-scientist/what-is-chromatography/
3. https://chem.libretexts.org/Bookshelves/General_Chemistry/Book%3A_General_Chemistry%3A_Principles_Patterns_and_Applications_(Averill)/22%3A_The_d-Block_Elements/22.03%3A_Metallurgy
4. https://www2.lbl.gov/abc/wallchart/chapters/03/0.html
5. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Acids_and_Bases/Acid/Overview_of_Acids_and_Bases

Pedagogy:

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

Rationale for nature of Course:

Knowledge and Skill:

Students acquire knowledge on volumetric method of analysis, principles for analytical chemistry, ores- occurrence and extraction process, radioactive and acid base.

Activities to be given: Find out the nature of compounds using Thin layer chromatography.

Course Learning Outcomes (CLOs)

CLOs	Course Learning Outcomes statements	Knowledge Level (According to Bloom's Taxonomy)
CLO 1	know the terminology: molality, molarity, normality, mole fraction	K1 to K3
CLO 2	Compare the types of chromatography	K1 to K3
CLO 3	Provide detailed on Refining of metals:	K1 to K4
CLO 4	Apply concepts of Radioactivity	K1 to K3
CLO 5	Studies HSAB principle and its applications	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)

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

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

LESSON PLAN: TOTAL HOURS (60 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
I	UNIT: I ANALYTICAL CHEMISTRY-I: a) Volumetric methods of analysis: Introduction- principle- terminology: molality, molarity, normality, mole fraction -titration- end point- indicator - types of indicators - Standard solution- types of standard solution- requirements of primary standard solution. b) Acid-base titration: Types- titration curves and choice of indicators- Ostwald's theory-theory of acid- base indicators. c) Redox titration: Definition with examples- theory of redox indicators (Action of Phenolphthalein and methyl orange).	**12**	Chalk and Talk, PPT, and quiz
II	UNIT: II ANALYTICAL CHEMISTRY- II: a) Chromatography: Definition- principle of chromatography- types of chromatography- experimental techniques and applications of column chromatography- thin layer chromatography and paper chromatography- R_f value and factors affecting R_f value**.** b) Colorimetric method of analysis: Introduction- principle- Beer- Lambert's law- criteria for satisfactory colorimetric estimations- Duboscq colorimeter- estimation of Fe^{3+} ion	**12**	Chalk and Talk, PPT, quiz and You tube Links

III	UNIT: III PRINCIPLES AND PROCESS OF METALLURGY:a) Ores and minerals: Definition-examples -various steps of metallurgy-crushing, pulverizing concentration of the ore-calcination and roasting- reduction into metals (Alumino-thermic process). b) Refining of metals: Electrolytic refining, Zone refining and Van-Arkel process	**12**	Chalk and Talk, PPT, quiz, seminar and Virtual Labs
IV	UNIT : IV NUCLEAR CHEMISTRY Radioactivity- definition – nature of radiations from radioactive substances – comparison of the properties of α, β and γ radiations- detection and measurements of radioactivity –Geiger Muller counter – radioactive decay – group displacement law – radioactive decay series – artificial radio activity - nuclear fission-atom bomb- nuclear fusion- hydrogen bomb- applications of radioactive isotopes- carbon dating	**12**	Chalk and Talk, PPT, quiz and group discussion
V	UNIT: V ACIDS, BASES AND OXIDATION AND REDUCTION:Modern concepts of acids and bases: Arrhenius, Bronsted- Lowry, Lewis and Lux-Flood; Relative strengths of acids and bases – amphoteric solvents-levelling effects. b) Hard and soft acids and bases: Pearson's concept –HSAB principle and its applications. c) Oxidation and Reduction: Definitions- oxidation number-differences between oxidation number and valency- rules for calculating oxidation number- solved examples-oxidizing and reducing agents- redox reactions-balancing of redox equations by oxidation number method.	**12**	Chalk and Talk, PPT, quiz, Open book test
	Total Hours	**60**	

Course Designer: Mrs.K.Punitha

Annexure-13

Department of Chemistry						Class: III B.Sc (N&D) & Physics		
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
V & VI	Generic Elective Course lab	**22OUNDGECH6P/ 22OUPHGECH6P**	Volumetric Analysis	1	2	40	60	100

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

Volumetric Analysis:

Acidimetry and alkalimetry

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 oxalic acid using standard sodium hydroxide

Dichrometry.

Estimation of Ferrous ammonium sulphate using Oxalic acid

Iodometry and iodimetry

Estimation of ferrous sulphate using standard Mohr's salt.

II. Redox Titrations:

a) Permanganometry:

Estimation of potassium permanganate using standardsodium hydroxide.

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 (60 Hrs)

UNIT	DESCRIPTION	HOURS	MODE
1	Instructions	5	Chalk and Talk, Group discussion
2	Estimation of sodium hydroxide using standard sodiumcarbonate.	7	Discussion, Data interpretation
3	Estimation of hydrochloric acid using standard oxalic acid.	7	Discussion, Data interpretation
4	Estimation of ferrous sulphate using standard Mohr's salt	7	Demonstration, Data interpretation
5	Estimation of oxalic acid using standard ferrous sulphate.	7	Discussion, Data interpretation
6	Estimation of potassium permanganate using standard sodium hydroxide.	7	Demonstration, Data interpretation
7.	Estimation of oxalic acid using standard sodium hydroxide	7	Discussion, Data interpretation
8	Estimation of Ferrous ammonium sulphate using Oxalic acid	7	Discussion, Data interpretation
9	Model Exam	6	
	Total	60	

Course Designer: 1. Mrs.K.Punitha

Annexure-13

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	10
2	Procedure	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	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.