PG DEPARTMENT OF CHEMISTRY

SYLLABUS

2019-2021 BATCH

FACULTY MEMBERS

Dr. K. POONKODI, M.Sc., M.Phil., Ph.D.

Dr. V. PRABHU, M.Sc., Ph.D.

Dr. M. SUGANTHI, M.Sc., M.Phil., Ph.D.

Ms. R. MINI, M.Sc., M.Phil., (Ph.D)

Ms. M. ANUSUYA, M.Sc., M.Phil., (Ph.D)

NGM COLLEGE (Autonomous)
Affiliated to Bharathiar University
Re-Accredited with 'A' grade by NAAC & ISO 9001:2015 certified
90, Palghat road, Pollachi- 642001, Coimbatore (Dist)
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NGM College

Vision

Our dream is to make the college an institution of excellence at the national level by imparting quality education of global standards to make students academically superior, socially committed, ethically strong, spiritually evolved and culturally rich citizens to contribute to the holistic development of the self and society.

Mission

Training students to become role models in academic arena by strengthening infrastructure, upgrading curriculum, developing faculty, augmenting extension services and imparting quality education through an enlightened management, committed faculty who ensure knowledge transfer, instill research aptitude and infuse ethical, cultural values to transform students into disciplined citizens in order to improve quality of life.

PG DEPARTMENT OF CHEMISTRY

Vision

An effective Teaching – Learning adjunct to cater the need of industry in the context of the developing needs of the country.

Mission

The Chemistry Department pledges itself to encourage in the broadest and most liberal manner, the advancement of science and particularly chemistry in all of its branches through its education, research, and service missions.

SCHEME OF EXAMINATION

SEM	Course Code	Title of the Paper	Duration in hours per week	Examination				Credits
				Hours	CIA	ESE	Total	
I	19PCY101	Inorganic Chemistry -I	5	3	25	75	100	5
I	19PCY102	Organic Chemistry -I	5	3	25	75	100	5
I	19PCY103	Physical Chemistry -I	5	3	25	75	100	5
I	19PCY207	Inorganic Chemistry Practical-I	5	--	--	--	--	--
I	19PCY208	Organic Chemistry Practical-I	5	--	--	--	--	--
I	19PCY209	Physical Chemistry Practical -I	5	--	--	--	--	--
TOTAL MARKS							**300**	**15**

SEM	Course Code	Title of the Paper	Duration in hours per week	Examination				Credits
				Hours	CIA	ESE	Total	
II	19PCY204	Inorganic Chemistry-II	5	3	25	75	100	5
II	19PCY205	Organic Chemistry-II	5	3	25	75	100	5
II	19PCY206	Physical Chemistry-II	5	3	25	75	100	5
II	19PCY2N1/ 19PCY2N2	*Non-Major Elective: Chemistry in day today life / Chemistry in context	1	3	--	100	100	2
II	19PCY207	Inorganic Chemistry Practical - I	5	6	40	60	100	3
II	19PCY208	Organic Chemistry Practical-I	5	6	40	60	100	3
II	19PCY209	Physical Chemistry Practical -I	4	6	40	60	100	4
* Students can choose any one of the papers as electives								
TOTAL MARKS							**700**	**27**

SEM	Course Code	Title of the Paper	Duration in hours per week	Examination				Credits
				Hours	CIA	ESE	Total	
III	19PCY310	Organic Chemistry -III	5	3	25	75	100	5
III	19PCY3E1/ 3E2/3E3	* **Major Elective-I** Spectroscopy/ Applied Electro Chemistry/ Polymer Chemistry	5	3	25	75	100	5
III	19PCY311	Physical Chemistry - III	5	3	25	75	100	5
III	19PCY3E4/ 3E5/3E6	* **Major Elective –II** Green, Nanochemistry and Cyber Security/ Water Pollution and Industrial Effluents treatment / Nano Technology and Supra Molecular Chemistry	3	3	25	75	100	3
III	19PCY414	Inorganic Chemistry Practical -II	4	6	--	--	--	--
III	19PCY415	Organic Chemistry Practical -II	3	6	--	--	--	--
III	19PCY416	Physical Chemistry Practical -II	3	6	--	--	--	--
III	19PCY417	Project Work/Literature review	2	6	40	--	40	--
	* Students can choose any one of the papers as electives							
TOTAL MARKS							**440**	**18**

SEM	Course Code	Title of the Paper	Duration in hours per week	Examination				Credits
				Hours	CIA	ESE	Total	
IV	19PCY412	Inorganic Chemistry -III	5	3	25	75	100	5
IV	19PCY4E7/ 4E8/ 4E9	*** Major Elective-III** Medicinal Chemistry/ Food Science and Technology/ Dye Chemistry	4	3	25	75	100	3
IV	19PCY413	Physical methods in chemistry	5	3	25	75	100	5
IV	19PCY414	Inorganic Chemistry Practical -II	5	6	40	60	100	3
IV	19PCY415	Organic Chemistry Practical -II	4	6	40	60	100	3
IV	19PCY416	Physical Chemistry Practical -II	4	6	40	60	100	4
IV	19PCY417	Project Work & viva voce	3	6	40	120	160	7
* Students can choose any one of the papers as electives							760	30
TOTAL MARKS							**2200**	**90**

LIST OF ELECTIVES

SEMESTER	SUBJECT CODE & TITLE
III	**MAJOR ELECTIVE-I** 19PCY3E1- Spectroscopy 19PCY 3E2- Applied Electro Chemistry 19PCY 3E3- Polymer Chemistry
III	**MAJOR ELECTIVE-II** 19PCY3E4- Green, Nanochemistry and Cyber Security 19PCY 3E5- Water Pollution and Industrial Effluents treatment 19PCY 3E6- Nano Technology and Supra Molecular Chemistry
IV	**MAJOR ELECTIVE-III** 19PCY4E7- Medicinal Chemistry 19PCY 4E8 - Food Science and Technology 19PCY 4E9- Dye Chemistry

Bloom's Taxonomy Based Assessment Pattern

K1- Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze; **K5**- Evaluate

1. Theory: 75 Marks

(i) TEST- I & II and ESE:

Knowledge Level	Section	Marks	Description	Total
K1 & K2	A(Answer all)	5x1=5 5x1=5	MCQ Define	75
K3	B (Either or pattern)	5x5=25	Short Answers	
K4& K5	C(Answer 4 out of 6) 16th Question Compulsory	4x10=40	Descriptive/ Detailed	

2. Theory: 100 Marks (NME)

Knowledge Level	Section	Marks	Description	Total
K3	A(Answer 5 out of 8)	5x5=25	Short Answers	100
K4 & K5	B (Answer 5 out of 8)	5 x 15=75	Descriptive/ Detailed	

3. Practical Examinations:

Knowledge Level	Section	Marks	Total
K3	Experiment & Record work	60 (External)	100
K4		40 (Internal)	
K5			

4. Project:

Knowledge Level	Section	Marks	Total
K3 K4	1. Internship (or) Reprint Presentation (III) Semester - (Internal)	40	200
	2. Literature Review & Presentation (IV) Semester - (Internal)	40	
K5	Project report present & viva (External)	120	

Components of Continuous Assessment

Components		Calculation	CIA Total
Test 1	75	$\frac{75+75+25}{7}$	25
Test 2	75		
Assignment/Seminar	25		

Programme Objectives

PO1. Students should have an advanced level understanding of at least three of the following areas of chemistry - Analytical, Inorganic, Organic, and Physical Chemistry. They should have a graduate level understanding of their major area(s) of research.

PO2. Students should be able to communicate scientific results in writing and in oral presentation.

PO3. Students should acquire the basic tools needed to carry out independent chemical research. Students should become proficient in their specialized area of chemistry and successfully complete an advanced research project.

Programme Specific Outcomes

PSO1 To acquire broad knowledge of descriptive chemistry.

PSO2 To impart the basic analytical and technical skills to work effectively in the various fields of chemistry.

PSO3 To motivate critical thinking and analytical skills to solve complex chemical problems which includes analysis of data, synthetic logic, spectroscopy, team-based problem solving, etc.,

PSO4 To demonstrate the ability to perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions.

PSO5 To demonstrate the ability to synthesize, separate and characterize compounds using published reactions, protocols, standard laboratory equipment, and modern instrumentation.

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY101**	**Inorganic Chemistry -I**	**Batch :**	2019-2021
			Semester	I
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To have knowledge about the principles of solid state chemistry, acid base concepts and inorganic chains, rings and clusters.
- To introduce principles of nuclear model, modes of decay and detection, measurement of radio activity, nuclear reactors and applications.

Course Outcomes (CO)

K1	CO1	To remember the introduction to crystal systems, acids and bases and nuclear chemistry.
K2	CO2	To understand the electrical properties of solid state, to comprehend different concepts of acids and bases, To deduce the apprehend radioactive and counter techniques.
K3	CO3	To implement the applications of non-aqueous solvents in reactions.
K4	CO4	To analyze coordination number, radius ratio and structure of ionic crystals. To evaluate n/p ratio, binding energy and Q-value of nuclear reactions.

Unit-1

Solid state **13Hrs**

Close packing of spheres - packing efficiency - hexagonal close packed (hcp) and cubic close packed (ccp) structures - coordination number - tetrahedral and octahedral holes - limiting radius ratio rule. Study of structures of rutile, fluorite, antifluorite, zinc blende, wurtzite, perovskite, ilmenite and spinels.

Metallic state - *free electron theory* and band theory - point defects in solids - Schottky and Frenkel defects - dislocations. Electrical properties of solids - insulators - intrinsic semiconductors - impurity semiconductors (n and P type) - super conductivity - Meissner effect - BCS (cooper pair) theory.

Unit-2

Modern concepts of Acids and bases **13Hrs**

Lewis concept - levelling solvents - solvent system concept- Lux-flood concept - Cady-Elsey concept - Usanovich concept - HSAB principle - Pearson concept – Theories of Hardness and Softness – Acid and base strength of HSAB, limitations and applictaions of HSAB.

Non aqueous solvents – Levelling effect of the solvent - classification of solvents, characteristic properties of ionizing solvents – chemical reactions in liquid ammonia, liquid HF, liquid N_2O_4, liquid SO_2 and oxyhalide solvents.

Unit-3 **13Hrs**

Chains – catenation, heterocatenation, isopolyanions, heteropolyanions (explanation with examples).

Cages –Structure and bonding of phosphorous compounds, boranes, carboranes and metallocene carboranes.

Metal clusters - Structure and bonding of dinuclear, trinuclear, tetra nuclear and hexa nuclear clusters - polyatomic zintl anions and cations - chevral phases - fullerenes and their applications.

Rings - borazines - phosphonitrilic compounds- sulphur - nitrogen ring compounds (S_4N_4).

Unit-4

Nuclear Chemistry **13Hrs**

Stability of nuclei - packing fraction - even - odd nature of nucleons - n/p ratio - nuclear potential - binding energy and exchange forces - shell model and liquid drop model.

Decay of radio nuclei: rate of decay - determination of half-life period - secular equilibrium and decay series. Modes of decay: alpha, beta, gamma and orbital electron capture - nuclear isomerism - internal conversions.

Nuclear Reactions

Q – value, columbic barrier – nuclear cross section – different types of nuclear reactions projectile capture – particle emission, spallation, fission and fusion – Product distributions – theories of fission, use of fission products, fissile and fertile isotopes- U-238, U-235, Pu-239, Th-232 – Stellar energy.

Unit-5 **13Hrs**

Radioactive and Counting techniques - tracer technique, neutron activation analysis, Particle acceleration: linear accelerator - cyclotron and synchrotron - betatron - G.M counter - proportional and scintillation counters.

Radio Isotopes: Applications – isotopes as tracers – uses in structure and mechanistic studies – carbon dating, industry, medicine and agriculture- Hot-atom chemistry-Safety measures- *Disposal of nuclear waste.*

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Power Point Presentation: Solid state

Seminar: Concepts of acids and bases

Assignment: Applications of Radio isotopes.

Books for Study:

1. B. R. Puri, L. R. Sharma and Madan S. Pathania (2006). Principles of Inorganic Chemistry. 41st edition. Vishal Publishing Co.
2. Gurdeep Raj. (2014). *Advanced Inorganic Chemistry*. 12th Edition. Geol Publishing House
3. Madan. R.D. (2011). *Advanced Inorganic Chemistry*. 3rd Edition. S. Chand & company, New Delhi.
4. Arnikar, H.J. (2000). *Essentials of Nuclear Chemistry*. 4th Edition. New Age International

Books for Reference:

1. Keith F. Purcell, John. C. Kotz. (1980). *Inorganic chemistry*, Holt- Saunders International Editions
2. James E. Huheey. (1997). *Inorganic chemistry Principles of structure and reactivity*, 4th Edition. Pearson India Limited.
3. F. A. Cotton and G. Wilkinson. (2014). *Advanced Inorganic Chemistry.* 6th edition. Wiley & Sons.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	S	M	H	S
CO2	H	M	H	S	H
CO3	M	S	S	M	M
CO4	M	H	H	M	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms.M.Anusuya Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY102**	**Organic Chemistry -I**	**Batch :**	2019-2021
			Semester	I
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To motivate the students to comprehend a knowledge on aromaticity and reaction mechanism.
- To learn about electrophilic, Elimination reactions and nucleophilic substitution reactions.
- To learn about the basic ideas about organic reaction intermediates.

Course Outcomes (CO)

K1	CO1	To keep in mind the reaction mechanisms in Organic Chemistry, Aromaticity
K2	CO2	To understand aromaticity, methods of determination of reaction mechanisms and to comprehend different types of substitution, addition and elimination reactions.
K3	CO3	To apply the mechanisms in solving chemical reactions.
K4	CO4	To review different types of reactions involved in chemical synthesis.

Unit-1

Aromaticity **13Hrs**

Aromatic character – *Huckel's Molecular orbital theory for aromaticity (HMO),* concept of aromaticity and anti aromaticity – Critereia for aromaticity, Non-benzenoid aromatic compounds-Monocyclic and bicyclic non-benzenoid neutral compounds (Annulenes and azulenes). Antiaromatic and Homoaromatic compounds- Alternant and non-alternant hydrocarbons.

Kinetic and Non-kinetic Methods of Determination of Reaction Mechanisms

Kinetic and thermodynamic control of chemical reactions – Hammond postulate – Linear free energy relationship (Hammet equation) - significance of substitution and reaction constant - limitations and deviations - Taft equation.

Methods of determining intermediates-Identification of products, detection of intermediate, cross over experiments, isotope labeling, stereochemical evidence, Primary and secondary kinetic isotopic effects.

Unit-2 - Electrophilic substitution reactions **13Hrs**

Aliphatic electrophilic substitution reactions – Mechanism

SE1, SE2 and SEi mechanism. Factors affecting reactivity in SE reactions - Typical reactions –hydrogen exchange and migration of double bond, halogenation of carbonyl compounds.

Aromatic electrophilic substitution reactions

Arenium ion mechanism - orientation and reactivity in mono substituted benzene rings – steric effects and ortho/para ratios - ipso attack, orientation in di-substituted benzene rings. Typical reactions - Friedel Crafts alkylation & acylation, Vilsmeier-Haack reaction, Gattermann-Koch reaction, Hofmann-Martius, Jacobsons reaction, Houben-Hoesch reaction, Diazonium coupling and Bischler- Napieralski reaction.

Unit-3 - Nucleophilic substitution reactions 13Hrs

Aliphatic nucleophilic substitution

S_N1, S_N2 and S_Ni reactions and mechanisms - factors affecting nucleophilic substitution reaction - neighbouring group participation (NGP) - ambident nucleophiles and ambident substrates. Substitution at vinyl carbon and allylic carbon - hydrolysis of esters ($A_{Ac}1$, $A_{Ac}2$, $B_{Al}1$, $B_{Ac}2$ only). Typical reactions - Wurtz reaction - Claisen and Dieckmann condensation - Williamson reactions.

Aromatic nucleophilic substitution: S_NAr - benzyne mechanism - Zeigler alkylation - Chichibabin reaction - Vonbraun reaction - Cine substitution.

Unit-4

Elimination reactions 13Hrs

E1, E2, E1cB - stereochemistry of elimination, Hofmann and Saytzeff's rules - *comparison between elimination and substitution* - pyrolytic cis elimination- Chugaev reaction – dehydration of alcohols, dehalogenation of vicinal dihalides, Hofmann degradation, Cope elimination- Bredt's rule with examples.

Unit-5

Reactive Intermediates 13Hrs

Generation and stability of reactive intermediates - Classical and non-classical carbocations, carbanions, carbenes and nitrenes.

Free radicals - Identification by chemical and spectral methods - free radical halogenations, Sandmeyar, Gomberg, Ullman, Pschorr and Hunsdiecker reactions.

Addition Reactions

Electrophilic and nucleophilic addition to double and triple bonds - hydration, hydroxylation, *Michael addition*, hydroboration and epoxidation, addition to carbonyl compounds.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment	: Naming reactions
Power point presentation	: Hammet and Taft equation, electrophilic and nuclephiic substitution reactions
Seminar	: Addition reactions

Books for Study:

1. S.M.Mukherjee and S.P.Singh (2004), *Reaction Mechanism in Organic Chemistry*. 10th Edition, Macmillan India Ltd.
2. Agarwal, O.P. (2014). *Reactions and Reagents in Organic Chemistry*. 49th Edition. Goel publishing house.
3. Ahluwalia, V.K. Rakesh K. Parashar (2010). *Organic Reaction Mechanisms*. 4th Edition. Narosa Publsihing House.
4. Tewari, KS, Vishnoi (2006). NK A *Text book of Organic Chemistry*. 3rd Edition. Vikas Publication.
5. Jagadambal and Singh (2014) *Advanced Organic Chemistry*. 20thEdition. Pragati prakasham publishers.

Books for Reference:

1. Finar, I.L. (2002) *Organic Chemistry. Vol.1*. 5th Edition. Pearson India Ltd.
2. Jerry March (2007) *Advanced organic chemistry*. 4th Edition, A Wiley-Interscience.
3. Morrison, R.T, Boyd, R.N (2013) *Organic Chemistry*.7th Edition. Pearson India Ltd.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	L	S
CO2	S	S	S	L	S
CO3	S	S	S	L	S
CO4	S	S	S	L	S

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY103**	**Physical Chemistry -I**	**Batch :**	2019-2021
			Semester	I
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To give a thorough introduction to the study of group theory.
- To learn about rate and order of the various reactions.
- To know about macro molecules.

Course Outcomes (CO)

K1	CO1	To keep in mind different symmetry operations, to recollect rate of chemical reactions.
K2	CO2	To comprehend the point groups of various molecules and to understand the different theories of chemical kinetics and to get the idea about molecular weight determination, kinetics and stereochemistry of macromolecules.
K3	CO3	To apply orthogonality theorem to different point groups and to apply group theory to bonding and hybridization of orbital's.
K4	CO4	To estimate the molecular weight and stereochemistry of macromolecules.

Unit-1

Group theory-I: **13Hrs**

Symmetry elements and symmetry operations - identity element - centre of symmetry- reflections symmetry planes - proper and improper rotation axes of symmetry. Groups definition, properties-order of group- types of groups- Abelian group, nonabelian group, sub group, isomorphic group - similarity transformation and classes.

Point group classification- identification of point groups of simple molecules -group multiplication table – orthogonality theorem and properties of irreducible representations - application of the orthogonality theorem to obtain the irreducible representations of the point groups C2v, C3v.

Unit-2

Group theory-II **13Hrs**

Character tables – Transformation of matrices-construction of the character table for C_{2v} and C_{3v} point groups - direct product representation - wave function as bases for irreducible representation - spectral transition probabilities - Symmetry Adapted Linear Combinations (SALC) - projection operators and their use to construct SALC - Huckel approximation -concept of hybridization - secular determinant - symmetry factoring of secular equations.

Symmetry selection rule for IR, Raman spectra and rotational spectroscopy - infrared spectral activity of vibrational modes in NH_3 and H_2O molecules - *mutual exclusion principle* - classification of vibrational modes - application of group theory to bonding: hybridization scheme for orbital in simple molecules - AB_4 (T_d, CH_4), AB_5 (D_{3h} $Fe(CO)_5$) and AB_6 (O_h $[Co(NH_3)_6]^{3+}$).

Unit-3

Chemical Kinetics-I **13Hrs**

Simultaneous reactions - opposing, parallel and consecutive reactions - the steady state approximation - theories of reaction rates - Arrhenius theory - collision theory - classical collision theory- modified collision theory - causes of weaknesses of the collision theory - absolute reaction rate or transition state theory - Statistical mechanical derivation of the rate equation - thermodynamical formulation of reaction rate, Lindeman's theory of unimolecular reactions.

Kinetics in liquid solution - Salt effect - primary salt effect and secondary salt effect - significance of salt effect - effect of pressure on rates of reactions in solutions.

Unit-4

Chemical Kinetics-II **13Hrs**

Experimental methods of fast reactions - shock tubes and pulse radiolysis techniques - chain reactions - general characteristics - kinetics of decomposition of N_2O_5, H_2-Cl_2.

Photochemical reactions and H_2-Br_2 thermal reaction - non-stationary chain reaction - H_2-O_2 reaction and explosion limits. Effect of temperature, relative permittivity, ionic strength and solvent (Grunwald-Winstein equation) on reaction rates.

Unit-5

Kinetics of polymerizations **13Hrs**

Addition and condensation polymers, determination of molecular weights - number average, weight average, sedimentation and viscosity average molecular weights of macromolecules. Kinetics of polymerization - free radical mechanism. *Techniques of Polymerisation: bulk, emulsion, solution and suspension,* Stereochemistry of polymers, Polymer processing - types of moulding - casting, spinning and vulcanization.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Experience Discussion, Brain storming activity and Case study

Assignment : Types of moulding - casting, spinning and vulcanization.

Power point presentation : Application of the orthogonality theorem to obtain the Irreducible representations of the point groups C2v, C3v,

Seminar : Polymer processing

Books for Study:

1. Raman, K.V. (1996), *Group Theory and its applications to chemistry,* Tata McGraw Hill publishing company Ltd.
2. Bhattacharya, P.K. (1986) *Group theory and its chemical applications*, Himalaya Publishing House
3. M. S. Gopinathan and V. Ramakrishnan, (1988), *Group Theory in Chemistry*, Vishal Publishers.
4. Gurudeep Raj (2014). *Chemical Kinetics*, Krishna Educational Publishers.

5. Billmeyer. F.W (1994) Text book of polymer science 3rd Edition, Thomson press (India) Ltd.
6. Gowariker. V.R (1986) Polymer science Wiley Eastern Ltd

Books for Reference:

1. Cotton, F.A. (1990) *Chemical applications of group theory*, 3rd Edition, A Wiley Interscience Publication.
2. Laidler. K. J (1987) *Chemical Kinetics* 3rd Edition. Pearson Education India.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	H	S	L	M
CO2	S	S	S	L	H
CO3	S	S	S	L	L
CO4	S	S	L	L	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: K. Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY204**	**Inorganic Chemistry –II**	**Batch :**	2019-2021
			Semester	II
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To know about theories of bonding in inorganic complexes and application, substitution reaction mechanism of coordination complexes, electron transfer mechanism of coordination complexes.
- To apply the knowledge of coordination chemistry to research.
- To promote awareness about organometallic compounds.

Course Outcomes (CO)

K1	CO1	To recollect the difference between complexes and double salts, To remember the ligands, its type and coordination number of complexes.
K2	CO2	To understand different concepts of coordination chemistry, to comprehend the electronic spectra, to get the idea of different reaction mechanisms of complexes, to figure out the synthesis and properties of organometallics.
K3	CO3	To apply electrochemical method in determination of stability constant.
K4	CO4	To analyze 10Dq and B values for octahedral complexes.

Unit-1

Coordination Chemistry –I **13 Hrs**

Theories of coordination compounds - *valence bond theory* - crystal field theory - splitting of d orbitals in different symmetries - crystal field stabilization energy - factors affecting the magnitude of 10 Dq - evidence for crystal field stabilization - spectrochemical series - applications of CFSE- tetragonal distortion from octahedral symmetry - Jahn-Teller distortion. Molecular orbital theory - octahedral complexes - pi bonding theory - experimental evidence for pi bonding.

Stability of complex ions-factors affecting the stability of complex ions- Irving-William series-relation between stepwise formation constant and overall formation constant, determination of stability constant by electrochemical method.

Unit-2

Coordination Chemistry –II **13 Hrs**

Quantum number of multi electron atoms- R-S coupling and micro states- ground state terms of d^1 to d^{10}- Hund's rule in determination of low energy states - derivation of terms for p^2, p^3 and d^1, d^2 ions.

Electronic spectra of coordination compounds - selection rules - band intensities and band widths - charge transfer spectra- effect of Jahn-Teller distortion and spin orbit coupling on spectra - Nephelauxetic effect, Orgel diagrams - Tanabe-Sugano diagrams (for d^2 and d^5 systems only) - calculation of 10Dq and B for V^{3+}(oct) and Ni^{2+}(oct) complexes.

Unit-3

Coordination Chemistry –III **13 Hrs**

Labile and inert complexes - Substitution reactions in square planar complexes - the rate law for nucleophilic substitution in a square planar complex - the trans effect - theories of trans effect - uses of trans effect. Ligand substitution reactions in octahedral complexes - types and mechanism of substitution reactions S_N1 and S_N2 type - acid hydrolysis reaction- catalysed aquation type, base hydrolysis reaction - S_N2 and S_N1CB mechanism - anation reactions. Kinetics of octahedral substitution - ligand fields effects - reaction rates - racemisation and isomerisation.

Mechanisms of redox reactions - outer sphere mechanisms - excited state outer sphere electron transfer reactions - inner sphere mechanisms - complementary and non complementary reactions.

Unit-4

Organometallic Chemistry – I **13 Hrs**

Definition of organometallic compound - 18 electron rule - EAN rule - concept of hapticity - classification of organometallic compound - the metal carbon bond types - ionic bond - sigma covalent bond - electron deficient bond - dative bond.

Metal carbonyls - methods of preparation, structure, reactions - metal carbonyl bonding - IR spectroscopy of metal carbonyls. Carbonylate ions, carbonyl hydrides, carbonyl halides - Wades rule, sytx number and isolobal relationship - metal nitrosyls.

Unit-5

Organometallic Chemistry – II **13 Hrs**

Synthesis, reactions, bonding and structure in metal alkene, alkyne, allyl ,dienyls and Cyclobutadiene complexes.

Preparation, properties, structure and bonding in cyclopentadienyl *complexes (Ferrocene),* arene complexes (Di benzene chromium), cyclo hepta trienyl complexes - basic concept of fluxional molecules.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : CFSE & MOT

Power point presentation : Orgel diagram and TB diagrams

Seminar : Mechanism of redox reaction

Books for Study:

1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller, F.A. Armstrong (2010) Inorganic Chemistry, 5th Edition, Oxford University Press
2. Malik, U.K, Tuli, G.D & Madan, R.D (2010). *Selected Topics in Inorganic Chemistry*, S. Chand Publication.
3. Gopalan .R , Ramalingam .V, (2001). Concise Coordination Chemistry, 3rd edition, Vikas Publishing house pvt Ltd
4. F.A. Cotton and G. Wilkinson, (1998). Advanced Inorganic Chemistry, 4th & 5th Edns, Wiley Interscience, New York,

Books for Reference:

1. Keith F. Purcell, John. C. Kotz. (1980). *Inorganic chemistry*, Holt- Saunders International Editions.
2. James E. Huheey. (1997). *Inorganic chemistry Principles of structure and reactivity*, 4th Edition. Pearson India Limited.
3. Basolo, F. & Pearson. R.G. (1967) *Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution.* Wiley Eastern Limited.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	L	M	L	M
CO2	S	S	S	M	H
CO3	S	S	M	H	L
CO4	S	S	S	H	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY205**	**Organic Chemistry –II**	**Batch :**	2019-2021
			Semester	II
Hrs/Week:	5	**Total Hrs: 6**5	**Credits:**	5

Course Objective

- To give a thorough introduction to the study of Oxidation, Reduction and alkaloids.
- To know the concept of Organic Photochemistry.
- To enable a comprehensive knowledge on conformational stereochemistry and pericyclic reactions.

Course Outcomes (CO)

K1	CO1	To keep in mind the basic of oxidation and reduction reactions, to remember the laws of photochemistry and to recollect the basic of optical activity
K2	CO2	To understand the different reagents involved in oxidation and reduction reactions, and to get the idea about photochemical reactions, to comprehend pericyclic reactions, to figure out isomerism and conformational analysis of stereochemistry and to understand the structural elucidation of alkaloids.
K3	CO3	To apply the reagents in chemical reactions, to execute photochemical and pericyclic reactions.
K4	CO4	To analyse the stereochemical isomerisation, configuration and conformations of molecules.

Unit-1

Oxidation **13 Hrs**

Chromyl chloride, ozone, DDQ, dioxiranes, lead tetraacetate, selenium dioxide, DMSO with either Ac_2O or oxalyl chloride, Dess-Martin reagent. Synthesis involving phase transfer catalysis (PTC), use of crown ethers, Merrifield resin, baker's yeast, Oppanauer oxidation, Jones oxidation.

Reduction

Catalytic hydrogenation - Wilkinson catalyst, dehydrogenation, reduction with $LiAlH_4$, $NaBH_4$, tertiary butoxy aluminum hydride, $NaCNBH_3$, tributyl tin hydride, alkali metals for reduction, reductions involving hydrazines, Clemmensen and Wolff kishner reduction, Birch reduction, MPV reduction.

Unit-2

Organic photochemistry **13 Hrs**

Laws of photochemistry - Beer-Lambert, Grothus-Draper law, Stark-Einstein law - electronic excitation - energy transfer - quantum efficiency - Jablonski diagram - chemical actinometry - photosensitization - quenching. Photochemistry of carbonyl compounds - photoreduction - Norrish type I and type II reactions, Photoadditions - Barton reaction- Patterno-Buchi reaction.

Photochemistry of olefins - cis and trans isomerization - dimerization reactions - cycloaddition reactions - 1,2 cycloadditions - photooxidation - photo substitution reactions of benzene derivatives.

Unit-3

Pericyclic reactions **13 Hrs**

Conservation of molecular orbital symmetry - symmetry properties of molecular orbitals. Electrocyclic reactions - 1,3-diene and 1,3,5-triene systems, correlation diagram and FMO method, Woodward-Hoffman selection rule for electroyclic reactions -con rotatory and dis rotatory motions 4nπ and (4n+ 2)π systems.

Cycloadditions reactions - correlation diagram and FMO approach, π2s + π2s, π2s + π4s (Diels-Alder reaction) systems. Woodward-Hoffman selection rule for cycloaddition reactions,

sigmatropic rearrangements - analysis of sigmatropic rearrangements by FMO method - 1,3 & 1,5 sigmatropic rearrangements, other sigmatropic shifts - Cope and Claisen rearrangements, ene reaction.

Unit-4

Stereochemistry **13 Hrs**

Optical isomerism – concept of chirality - concept of prochirality - axial chirality - (optical isomerism of biphenyls, allenes and spiranes)- planar chirality (optical isomerism of ansa compounds and cyclophanes) - helicity (optical isomerism of over – crowded molecules) - R, S – nomenclature of compounds having one and more than one chiral centres - enantiotopic and diastereotopic ligands & faces - stereo selective and stereo specific reactions – stereochemistry of sulfur and nitrogen compounds.

Geometrical Isomerism – E, Z – notation – Determination of configuration of geometrical isomers- stereoismerism of cyclic compounds (up to six membered ring)– aldoximes & ketoximes.

Conformational Analysis - configuration and conformation – Conformation of acyclic compounds –ethane, butane, cyclohexane, decalins – stability and reactivity in relation to conformation –perhydrophenanthrenes.

Unit-5

Alkaloids **13 Hrs**

Introduction - isolation of alkaloids, structural elucidation and synthesis of morphine, reserpine, quinine, atropine and papaverine.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : Reduction

Power point presentation : Pericyclic reactions

Seminar : Stereochemistry-Geometrical isomerisation

Books for Study:

1. Mukerjee S.M. & Singh, S.P. (2013) *Reaction mechanism in organic chemistry*, 3rd Edition, McMillan India Ltd
2. Ahluwalia, V.K. Rakesh K. Parashar (2010). *Organic Reaction Mechanisms*. 4th Edition. Narosa Publsihing House.
3. Kalsi. P.S. (1995). *Stereochemistry, Conformation and Mechanism*. 3rd edition. John Wiley sons.
4. Nasipuri. D (1994). *Stereochemistry of Organic Compounds.* New age International.
5. Agarwal O. P. (2001). *Natural product Chemistry*. 20th Edition Goel Publishing house.
6. Jagadambal and Singh (2014) *Advanced Organic Chemistry.* 20thEdition. Pragati prakasham publishers.

Books for Reference:

1. Depuy, C.H. & Chapman. O.S. (1972) *Molecular reactions and photochemistry*. Prentice Hall.
2. Eliel. E.L, Wilen. S.H. (1994) *Stereochemistry of Organic Compounds.* Wiley International
3. Potapov, V.M. Beknazarov. A. (1980) *Stereochemistry*. Mir Publications. Russia.
4. Jerry March (2007) *Advanced organic chemistry*. 4th Edition, A Wiley-Interscience.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	H	S	L	S
CO2	S	H	S	L	S
CO3	S	H	S	L	S
CO4	S	H	S	L	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY206**	**Physical Chemistry –II**	**Batch :**	2019-2021
			Semester	II
Hrs/Week:	5	**Total Hrs: 6**5	**Credits:**	5

Course Objective

- To motivate the students to comprehend a knowledge on quantum mechanics.
- Apply the quantum mechanical concept to simple molecules
- To learn the concepts of electro chemistry and fundamentals of photochemistry.

Course Outcomes (CO)

K1	CO1	To remember the dual character of electrons.
K2	CO2	To understand the concepts of classical and quantum mechanics, to picture out the failure of classical mechanics. To comprehend the approximate methods in quantum mechanics. To get the idea about electro kinetic phenomena and to understand the principles of photochemistry
K3	CO3	To apply the Schrödinger wave equation to particles in a system.
K4	CO4	To analyze the final solution, energy and wave function for H atom and to review the mechanisms and theories of electrokinetics and photochemistry.

Unit-1

Quantum Chemistry-I **13 Hrs**

Success of quantum theory and the failure of classical mechanics - basic concepts - black body radiation - time dependent and time independent Schrodinger equation - requirement of an acceptable wave function - operator concept as applied to quantum mechanics (basic ideas) – Derivation of energy and angular momentum operator-eigen functions and eigen values - postulates of quantum mechanics - application of Schrodinger equation to the particle in a box (1-D& 3-D Boxes) - particle in a ring & particle in spherical orientation.

Unit-2

Quantum Chemistry-II **13 Hrs**

Harmonic oscillator and rigid rotator - central force problem - H-atom - method of separation of variables - final solution - the energy and wave function for the problem - quantum numbers - shapes of the wave functions.

Approximation Methods: Approximate methods in quantum mechanics - need for the approximation methods - perturbation and variation methods applicable to H atom in ground state - He atom in the ground state and excited state, He^+ in the ground state - electron spin and Pauli's principle.

Unit-3

Quantum Chemistry-III **13 Hrs**

LCAO - MO methods - slater determinants - HMO treatment of simple and conjugated π-electron systems - ethylene, allyl, butadiene and benzene systems - delocalization energy-construction and use of hybrid orbitals - determination of bond order.

Unit-4

Electrochemistry -I **13 Hrs**

Conductance - transport number - Debye- Huckel- Onsager equation- Falkenhagen effect, Wein effect - ionic strength, Debye-Huckel limiting law and its verifications - electrode potential - concentration cells - liquid junction potential.

Electrokinetic phenomena: Theories of double layer - Helmoltz-Perrin, Gouy-Chapmann & Stern theories –Theories of over voltage and zeta potential- elecrodics - mechanism of electrode reactions - polarization and over potential - Butler-Volmer equation - electrophoresis and electro osmosis.

Unit-5 **13 Hrs**

Electrochemistry –II

Current-voltage relationships - Voltametry – Polarography - mass transfer - diffusion limited currents - kinetic currents - adsorption currents - amperometry, coulometry, cyclic voltametry, rotating disc electrodes, chronoamperometry, chronopotentiometry, chronocoulometry, conductometric and potentiometric titrations (basic principles and applications only in all the above methods).

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : Kinetics of heterogeneous catalysis

Power point presentation : Theories of double layer

Seminar : Electrochemistry

Books for Study:

1. Ira N. Levine. (2014) Quantum Chemistry, 7th Edition., PHI learning Pvt Ltd.,
2. Puri B.R & Sharma. L R. (2009) *Advanced Physical Chemistry*, 2nd Edition., Milestone Publishers & Distributors
3. Bajpai, D.N. (1992) *Advanced Physical Chemistry*, S. Chand Publishing Limited.
4. Chandra, A.K (1994) *Introductory Quantum Chemistry*, 3rd Edition, Tata McGraw Hill Publishing Company.
4. R. K. Prasad, Quantum Chemistry, TMH, 1995.
5. P.W. Atkins, Physical Chemistry, 6th Edn., Oxford University Press, 1998

Books for Reference:

1. Hanna. M. (1969) *Quantum Mechanics in Chemistry*. 2nd Edition. Addison Wesley Longman.
2. Mcquarrie, D.A. (2008) *Quantum Chemistry*. 2nd Edition University Science Book.
3. John O' M. Bockris, Amulya K.N. Reddy, Maria Gamboa-Aldeco, Maria E. Gamboa-Aldeco (1986). *Modern Electrochemistry*, Volume 2, Part 1 2nd Edition Springer International.
4. Glasstone, An Introduction to Electrochemistry (1943), Van Nostrand Co. Inc., Newyork.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	L	S	H	S
CO2	S	M	H	M	L
CO3	S	M	M	M	L
CO4	S	H	H	H	L

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. M. Anusuya Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY2N1**	**Non Major Elective-I Chemistry in Day to Day Life**	**Batch :**	2019-2021
			Semester	II
Hrs/Week:	1	**Total Hrs:** 13	**Credits:**	2

Course Objective

- After completion of the course the students should have understood industrial preparations of materials of application in day today life.
- To get an awareness about eco friendly products to lead sustainable life.
- To enable the student to understand about the manufacture of commercial products.

Course Outcomes (CO)

K1	CO1	To remember fundamental concepts of applied chemistry
K2	CO2	To understand the drugs used in day to day life. To comprehend about fertilizers and pesticides. To get the idea of paints and cleansing agents and to understand the chemistry of milk and milk products.
K3	CO3	To apply the various forms of drugs, cosmetics and milk products in day to day life.
K4	CO4	To analyze the composition of fertilizers, pesticides and milk products.

Unit-1 **3 Hrs**

Medicines - Antacid - Tranquilizers (Psychotherapeutic Drugs) – Analgesics – Antipyretics – Antimicrobials – Antibiotics – Antiseptics – Disinfectants

Chemistry in Food and Cosmetics - Artificial Sweetening Agents - Food Preservatives Analysis of pesticides and heavy metals, other adulterant

Unit-2 **3 Hrs**

Fertilizer type- *need for fertilizers*- essential requirements-NPK ratio-sources of fertilizers. Effect of nitrogen, potassium and phosphorous on plant growth.

Pesticides -classification of insecticides, fungicides, herbicides as organic and inorganic - general methods of application and toxicity. *Safety measures when using pesticides.* Identification of pesticides in food.

Unit-3 **2 Hrs**

Paints, varnish and lacquers- ingredients, characteristics and their uses.

Chemistry in Colouring Matter - Classification of Dyes on the Basis of Constitution - Classification of Dyes on the Basis of Application

Unit-4 **2 Hrs**

Cleansing agents- importance of cleansing; Soaps - classification, manufacture, dry cleaning-properties.

Unit-5 **3 Hrs**

Milk and Milk products-composition of Milk; Flavour and aroma of Milk; Physical properties of Milk; Effect of heat on Milk; pasteurization; Homogenization; milk products; Cream; butter; ice Cream; milk powder.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Group discussion **:** Hazardous effects of fertilizers and pesticides
Assignment **:** Cleansing agents

Books for Study:

1. Jayashree Ghosh, S. (2005) *Fundamental Concepts of Applied Chemistry*, Chand, Publications.

Books for Reference:

1. Ronald Bailey, Herbert Clark, James Ferris, Sonja Krause, Robert Strong (2001) *Chemistry of the environment* 2nd Edition Elsevier publications.
2. Jain.P.C. and Monica Jain (2005) *Engineering chemistry* 17th Edition, Dhanpat Rai, Publishing Company (P) Ltd.
3. http://www.ncerthelp.com

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	H	M	M	S
CO2	S	S	H	S	H
CO3	S	S	S	S	S
CO4	S	S	S	H	S

4. S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name:Dr. M.Suganthi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY2N2**	**Non Major Elective-II Chemistry In Context**	**Batch :**	2019-2021
			Semester	II
Hrs/Week:	1	**Total Hrs:** 13	**Credits:**	2

Course Objective

- To enable the student to understand about ecological systems.
- After completion of the course the students should have understood biological effects, energy sources and plastics.
- To get an awareness about eco friendly products to lead sustainable life.

Course Outcomes (CO)

K1	CO1	To remember different types of pollution
K2	CO2	To understand harmful effects of air pollution, to comprehend about the applications of solar energy and nuclear energy and to get idea about plastic and polymers.
K3	CO3	To implement the disposal of plastics.
K4	CO4	To analyze the hazards of air pollution and radioactivity

Unit-1 **3 Hrs**

Environment segment- The atmosphere- the air we breathe - composition of air - burning of hydrocarbons - fog - air quality - ozone - oxygen / ozone screen - biological effect of UV radiation - ozone formation and distribution in the atmosphere - paths of ozone destruction - chlorofluorocarbons and their interactions with ozone - the antartic ozone hole.

Unit-2 **3 Hrs**

Chemistry of global warming - *green house effect*- earth's energy balance - vibrating molecules and the green house effect - molecular response to radiation - methane and other green house gases - climate modeling.

Unit-3 **3 Hrs**

Renewable energy: Solar energy - fuel from sun light - splitting of water - hydrogen from sunlight - hydrogen economy - fuel cells - batteries - photovoltaics - stealing the sun.

Unit-4 **2 Hrs**

Non-renewable energy: Nuclear energy - nuclear fission and fusion - production of electricity by a nuclear reactor - radioactivity and the hazards of radioactivity - living with nuclear power.

Unit-5 **2 Hrs**

The world of plastics and polymers -3R principle-Reduce, Reuse and Recycle-polymers - polyethylene - plastics and recreation - paper or plastics - *disposal of plastics.*

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Group discussion **:** Hazardous effects of air pollution
Assignment **:** Batteries

Books for Study:

1. Jayashree Ghosh, S. (2005) *Fundamental Concepts of Applied Chemistry*, Chand, Publications.

Books for Reference:

1. Conard L. Stanitski. Luey Pyrde Eubenks. Catherine H. Middle Camp and Wilmer J. Stratton (2000) *Chemistry in Context: Applying Chemistry to Society*, 3rd Edition, Tata Mc Graw Hill.
2. Bailey, Clark, Ferris, Isrause, Strong, (2001) *Chemistry of the environment* 2nd Edition Elsevier publications.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	L	L	L	L	L
CO2	H	S	S	S	S
CO3	M	H	H	M	M
CO4	H	S	S	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. M. Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY207**	**Inorganic Chemistry Practical -I**	**Batch :**	2019-2021
			Semester	I &II
Hrs/Week:	5	**Total Hrs:** 130	**Credits:**	3

Course Objective

- To give an idea to the students about the separation and analysis of cations from the mixture of common and rare cations.
- To allow the students to know and practice the techniques in preparation of some inorganic complexes.

Course Outcomes (CO)

K3	CO1	To remember the analysis of cations alone.
K4	CO2	To understand the analysis of mixtures of cations each consisting of two familiar metal cations and two less familiar metal cations. To understand the preparation of complexes.
K5	CO3	To analyze and report two familiar metal cations and two less familiar metal cations. To prepare and report coordination compounds.

A. Semimicro QualitativeAnalysis:

Analysis of mixtures of familiar metal cations and the following less familiar metal cations - Tungsten, Selenium, Molybdenum, Cerium, Zirconium, Vanadium and Lithium.

Note: A minimum of FIVE inorganic mixtures, each containing of two familiar and two less familiar metal cations has to be analyzed by each student during the course.

B. Preparation of complexes

Any Five preparations selected from the following list:

Lead tetraacetate, Dipyridiniumhexachloroplumbate, Hydroxylaminehydrochloride, Ortho and para - hydroxy phenyl mercuric chloride, Potassium cupric chloride, Chrome alum Copper(I)Chloride, Trithio urea copper(I), Potassium trioxalato - aluminate(III), Potassium trioxalatochromate(III), Potassiumtrioxalatoferrate(III),

Hexaminecobalt(III)chloride,Chloropentamminechromium(III)chloride, Aquopentamminechromium(III) nitrate, Tetrammine copper(II) Sulphate, Ammonium hexachloro stannate (IV).

Books for Reference:

1. Ramanajum V.V, (1985) *Semimicro Qualitative Inorganic Analysis*.
2. VenkateswaranV.Veeraswamy R and Kulandaivelu A.R, (1997) *Principles of Practical Chemistry Sultan* Chand & Sons. 2nd Edition.
3. Giri. S. Bajpai D.N. & Panday, O.P. (1990). *Practical Chemistry* Vol. I & II, S. Chand & Co.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	L	L	M
CO2	H	S	L	H	S
CO3	H	S	L	L	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY208**	**Organic Chemistry Practical -I**	**Batch :**	2019-2021
			Semester	I &II
Hrs/Week:	5	**Total Hrs:** 130	**Credits:**	3

Course Objective

- To make the students aware about separation of mixture of organic compounds and analyzing the unknown compounds.
- To allow the students to know and practice the techniques of preparation of some organic compounds.

Course Outcomes (CO)

K3	CO1	To remember the analysis of organic compounds and aromatic substitution reactions.
K4	CO2	To understand the separation and analysis of organic mixtures. To understand the preparation of organic compounds involving the following reactions: hydrolysis, acetylation, bromination, nitration, benzoylation and oxidation. To get the idea about recrystallisation.
K5	CO3	To separate, analyze and report the components present in organic mixture. To prepare and recrystallise organic compounds.

A. Analysis of two component organic mixtures.

(Separation and characterization of individual compounds)

Note: Each student has to complete the analysis of minimum of FIVE Mixtures during the course

B. Single stage Preparations and Recrystallisation (Any Five)

1. **Hydrolysis:**
   Preparation of Benzoic acid from Benzamide.
2. **Acetylation:**
   Preparation of Acetanilide from Aniline.
3. **Bromination:**
   Preparation of p-Bromoacetanilide from Acetanilide.
4. **Nitration:**
   Preparation of m-dinitrobenzene from Nitrobenzene.
5. **Benzoylation:**
   Preparation of Benzanilide from Aniline.
6. **Oxidation:**
   Preparation of Benzoic acid from Benzaldehyde.
7. Preparation of Glucose penta acetate

Books for Reference:

1. Gnanaprakasam and Ramamurthy (1998). *Organic Chemistry Laboratory Manual*, Ananda Book Depot,Chennai.
2. Vishnoi N.K (2001). *Advanced Practical Organic Chemistry*, Vikas Publishing House,1992.
3. Jagmohan. R (2002). *Advanced Practical Organic Chemistry*, Vol. I &II.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	L	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms.M.Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY209**	**Physical Chemistry Practical -I**	**Batch :**	2019-2021
			Semester	I &II
Hrs/Week:	5&4	**Total Hrs:** 117	**Credits:**	4

Course Objective

- To promote an awareness about Potentiometric titrations to the students.
- To know, to interpret, evaluate and report upon observations and experimental results of determination of molecular weight, partition coefficient, unknown composition in Simple Eutectic System and acid-base, precipitation and redox titrations.
- To make the students apply colorimetric principle in estimation of metal ions.

Course Outcomes (CO)

K3	CO1	To keep in mind the procedure of titration. To recollect the concept of potentiometric titration. To remember the molecular weight determination by Rast method.
K4	CO2	To understand the simple eutectic system, molecular weight determination by Rast method, partition coefficient. To know about the acid base titration, redox titration and precipitation titration using potentiometry. To understand the estimation of metal ions using colorimetry.
K5	CO3	To determine the composition of unknown compound using simple eutectic system. To determine the molecular weight by Rast method. To determine the equilibrium constant using partition coefficient. To estimate the amount of ions present in the solution using potentiometry. To estimate the metal ions using colorimetry.

Non Electrical Experiments

1. **Properties of Matter**
   Simple Eutectic System- determination of unknown compositions

2. **Molecular weight determination**
   Determination of Molecular weight by Rast's micro method

3. **Partition coefficient**
   Determination of Equilibrium constant for the reaction
   $KI + I_2 \leftrightarrow KI_3$

Electrical Experiments -Potentiometric Titrations:

A. Acid-Base titrations (using quinhydrone electrode)

4. Titration of Strong acid against Strong base
5. Titration of Weak acid against Strong base
6. Titration of mixture of (strong & weak) acids against Strong base
7. Determination of pH (acidic solutions)
8. Determination of pKa of weak acid
9. P^H, pKa for Phosporic acid

B. Redox titrations

10. Titration of Potassium Iodide against Potassium Permanganate
11. Titration of Ferrous Ammonium Sulphate against Potassium dichromate

C. Precipitation titrations (using silver electrode)

12. Titration of Potassium chloride against Silver nitrate
13. Titration of mixture of halides (chloride and iodide) against silver nitrate

D. **Colorimetric Estimations** (using photoelectric colorimeter)

Estimation of Copper, Iron, Nickel, Manganese and Chromium.

Books for Reference:

1. Palit S.R and De S.K (2003) *Practical Physical Chemistry*, Science Book Agency, Calcutta.
2. Sharma P.C and Agarwal (1996). *Practical Chemistry*, Goel Publishing House, Meerut.
3. Venkateswaran Vand Kulaindaivelu A.R (1987). *Practical Physical Chemistry* S.Chand & Co.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	L
CO2	S	S	S	S	L
CO3	H	S	S	S	L

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY310**	**Organic Chemistry –III**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To promote an awareness in the student about natural products and their synthesis.
- To introduce new reagents available in organic synthesis.
- To synthesize eco-friendly reagents and chemical pathways for the development of green chemistry

Course Outcomes (CO)

K1	CO1	To remember the classes of natural products and the fundamental of condensation and molecular rearrangement reactions.
K2	CO2	To understand isolation, classification and structural elucidation of terpenoids and steroids. To comprehend the structure and synthesis of proteins, heterocyclic compounds and antibiotics. To get the idea about naming reactions which includes condensation and molecular rearrangements and to understand about the reagents in organic synthesis.
K3	CO3	To apply the reagents in organic synthesis.
K4	CO4	To review the molecular rearrangement, condensation, Reagents involved in organic synthesis and retro synthesis.

Unit-1

Terpenoids **13 Hrs**

Isolation and classification of terpenoids - isoprene rule, gem-dialkyl rule, structural elucidation and synthesis of zingiberene, eudesmol, abeitic acid and caryophyllene, α-pinene, α-santonin, Linalool.

Unit-2

Steroids **13 Hrs**

Introduction - structural elucidation of cholesterol (synthesis not required), ergosterol, Vitamin-D, Bile acid, testosterone and progesterone.

Unit-3

Proteins and Polypeptides: **13 Hrs**

Primary, secondary and tertiary structures of proteins - the N-terminal(Hydrazinolysis, reduction and carboxypeptidase methods only) and C- terminal residue analysis (phenylthiohydantoin,cyanate and DNP methods only) synthesis of

polypeptides (Sheehan's, Halpen's and Fischer's methods only), *enzymes*, *biosynthesis of proteins*, structure of DNA and RNA and their biological importance.

Heterocyclic compounds: Structure, synthesis and reactions of flavones, isoflavones, purines (adenine and guanine) and anthocyanins (cyanin and pelargonin) thymine, uracil, cytosine. Application of catechin, kaempferol and quercetin.

Unit-4

Condensation reactions: **13 Hrs**

Benzoin, Dieckmann, Darzen, Knovenagal, Mannich, Stobbe, Thorpe and Wittig reactions-Claisen and Dieckmann condensation.

Molecular rearrangements: Introduction - Wagner - Meerwein rearrangements, dienone phenol, Wolf, Favorski, Neber rearrangement, Baeyer-Villiger rearrangement, Stevens, Chapman, Benzidine, Fries, Ardnt Eister synthesis, Lossen and Wallac rearrangements, Curtius, Hoffmann- Lofller- Freytag, Demjanov, Von-Richter rearrangement, Sommelet-Hauser rearrangement, Smiles rearrangement

Unit-5

Reagents in organic synthesis: **13 Hrs**

Gilmans reagent, lithium di-methyl cuprate, lithium diisopropyl amide (LDA), trimethyl silyl iodide, Peterson's synthesis, Vilsmeier reaction. Preparations and synthetic applications of DBU (1,5-diazabicyclo[5.4.0] undecene-5), DCC (dicyclohexylcarbodiimide) , NBS, PCC, PDC, Wilkinson's catalyst.

Retrosynthetic Analysis: Retrosynthetic analysis of simple organic compounds- functional group interconversions - use of activation and protecting groups in synthesis.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : Molecular reaarangements

Power point presentation : Proteins and polypeptides

Quiz : Reagents in organic synthesis

Books for Study:

1. Finar. I. L (1998), *Organic Chemistry Vol. II*, Longman Publishing Group.
2. Agarwal O. P (2001), *Natural product Chemistry*, 20th Edition, Goel Publishing house.
3. Gurdeep Chatwal (2001), *Organic Chemistry of Natural Products Vol I& II*, Himalaya Publishing House.
4. Ahluwalia, V.K. Rakesh K. Parashar (2010), *Organic Reaction Mechanism*. 4th Edition, Narosa Publsihing House.
5. Stuart Warren. (1994). *Designing Organic Syntheses.* 1st edition. John Wiley and sons.

Books for Reference:

1. Jerry March (2007), *Advanced organic chemistry*, 4th Edition, A Wiley-Interscience.
2. Newman, A.A (1972, *Chemistry of Terpenes and Terpenoids*, Academic press publishers.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	M	M	S
CO2	S	H	S	L	S
CO3	S	H	M	M	S
CO4	S	M	S	L	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY3E1**	**Major elective-I Spectroscopy**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To interpret and solve problems using various spectra.
- To acquire knowledge in the structural determination of unknown compounds and various spectroscopic methods.
- To apply the spectral techniques in research

Course Outcomes (CO)

K1	CO1	To remember about electromagnetic radiation and its frequency region
K2	CO2	To understand the theory, instrumentation and applications of IR, UV, NMR and mass spectroscopy
K3	CO3	To apply the various spectroscopic ideas on molecules to know their structural properties.
K4	CO4	To interpret and solve structural problems using various spectra.

Unit-1 **13 Hrs**

Introduction to spectroscopy - Properties of electromagnetic radiation- Electromagnetic spectrum-Absorption and emission spectra.

IR Spectroscopy

The vibrating diatomic molecules - the simple harmonic oscillator- the diatomic rotator - vibrations of polyatomic molecules - the influence of rotation on the spectrum of polyatomic molecules - factors influencing vibrational frequencies - characteristic group absorptions of organic molecules- finger print region -identification of functional groups - applications to simple organic molecules -medical diagnosis (cancer)- instrumentation- FT-IR, NIR

Unit-2

UV and visible spectroscopy and Raman spectra **13Hrs**

Simple chromophoric groups- auxochromes - effects of conjugation - Woodward - Fischer rules - aromatic system and systems with extended conjugation $-\lambda_{max}$ calculation of butadiene and carbonyl compounds- applications to organic compounds - instrumentation.

Raman spectra – introduction – characteristic properties of Raman lines – differences between Raman spectra and IR spectra – mechanism of Raman Effect – Intensity of Raman lines – applications of Raman spectroscopy

Unit-3

Nuclear Magnetic Resonance Spectroscopy -^{1}HNMR **13 Hrs**

Magnetic properties of nuclei - theory of nuclear resonance - chemical shift and its measurement - factors influencing chemical shift - chemical equivalence and magnetic equivalence - solvents and NMR spectra - spin-spin coupling, spin-spin splitting systems - proton exchange reactions - heteronuclear coupling - deuterium exchange - double resonances - chemical shift reagents - applications to organic compounds - instrumentation - CW and FT NMR.

Unit-4 **13 Hrs**

^{13}C NMR: Magnetic moment and natural abundance- broad band decoupling - Off-resonance decoupling - deuterium coupling - NOE effect- - peak assignments using DEPT spectrum - structural applications of ^{13}C NMR spectroscopy.

Correlation NMR Spectroscopy: Theory - ^{1}H-^{1}H COSY, ^{1}H-^{13}C COSY: HETCOR, Proton detected HETCOR: HMQC, HMBC, NOESY.

Unit-5

Mass Spectrometry **13 Hrs**

Theory - *instrumentation* - isotopic abundance - determination of molecular weights and formula, ionisation techniques (CI, FD, FAB & ESI, APCI) - nitrogen rule -metastable ions and peaks - ion fragmentation mechanisms - Retro Diels-Alder rearrangement -Mclafferty rearrangement -elimination due to ortho groups. Fragmentation associated with functional groups - benzyl alcohol, phenol, methyl phenyl ether, benzaldehyde, 2-hexanone, benzoic acid, n-propyl ethanoate, and benzamide.

Solving problems using IR, UV, NMR and mass spectra for simple molecules. HR-MS,MS-MS, HREMS.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : Instrumentation of mass spectrometry
Power point presentation : IR and NMR
Quiz : Problem interpretation using spectroscopic data

Books for Study:

1. Sharma, Y.R. (2005), *Elementary Organic Spectroscopy*, 3rd Edition, S. Chand & Company Ltd.
2. Banwell. C.N. (1994), *Fundamentals of molecular spectroscopy*, 3rd Edition, Tata McGraw Hill Publishing Company Ltd.
3. Kemp, W. (1991), *Organic Spectroscopy*, 3rd Edition, Mc Millan Press Ltd.
4. Jagmohan, (2005) ,*Organic Spectroscopy Principles and Applications*, 2nd Edition , Narosa publishing house.
5. Kalsi, P.S. (2004), Spectroscopy of Organic Compounds, 6th Edition, New Age International Publishers.

Books for Reference:

1. Dyer, J. (1965), *Application of absorption spectroscopy of organic compounds*, Prentice and Hall of India Pvt., New Delhi.
2. Silverstien, Bassler and Morril, (2014), *Spectrometric identification of organic compounds*, 8th Edition, John Wiley and Sons, INC

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	M	L	M
CO2	S	S	S	L	S
CO3	S	S	S	L	S
CO4	S	S	S	L	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: R.Mini, M.Anusuya K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY3E2**	**Major Elective -I Applied Electrochemistry**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To have a good knowledge of electrochemical cells, batteries and electroplating.
- To know about corrosion and its control.

Course Outcomes (CO)

K1	CO1	To recollect the fundamentals of electrochemistry.
K2	CO2	To understand the principles and applications of various current-voltage instruments. To know about the various electrochemical cells and batteries. To comprehend the effects of corrosion and corrosion control
K3	CO3	To apply the various instrumental techniques to measure current and voltage. To apply the various corrosion control inhibitors and technique to control corrosion.
K4	CO4	To analyze current and voltage using various techniques.

Unit-1 **13 Hrs**

Current-voltage relationships - Voltametry – Polarography - mass transfer - diffusion limited currents - kinetic currents - adsorption currents - amperometry, coulometry, cyclic voltametry, rotating disc electrodes, chronoamperometry, chronopotentiometry, chronocoulometry, conductometric and potentiometric titrations (basic principles and applications only in all the above methods).

Unit-2 **13 Hrs**

Electrochemical cells - c*omponents of electrochemical cells* - Types of cells - divided and undivided cells - chlor-alkali cells mercury, diaphragm and membrane cells - electro-inorganic chemicals - chlorates, perchlorates - electrosynthesis of fluorine - electro-organic chemicals - electro-reduction of nitro and carbonyl groups - Kolbe synthesis-electro dimerisation - adiponitrile.

Unit-3

Electrometallurgy and Electroplating **13 Hrs**

Electrowinning and electro refining of Cu and Ni, production of aluminium - Hall-Heroult process - Electrolytic production of magnesium and sodium - Electroplating operations - preplating operations - electroplating of nickel and chromium - precious metal plating - anodizing of Al.

Unit-4

Batteries **13 Hrs**

Thermodynamics of batteries and fuel cells - half cell reactions in batteries - characteristic requirements of a battery system - *components of batteries* - porous electrodes - separators -evaluation of batteries - charge - discharge characteristics - primary batteries, lead acid batteries - Leclanche cells - lithium cells - Ni-Cd cells - High temperature batteries - sodium-sulphur system.

Unit-5

Corrosion and Corrosion Control **13 Hrs**

Thermodynamics of corrosion - Pourbaix diagrams - kinetics of corrosion - evans diagram - corrosion current and corrosion potential - Metal oxidation - atmospheric corrosion - crevice corrosion - bimetallic corrosion - stress corrosion - cracking - corrosion control and corrosion inhibitors - painting for corrosion control - cathodic protection - protection by sacrificial anodes.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : Current- voltage relationship
Seminar **:** Electrometallurgy and electroplating
Group discussion : Corrosion and corrosion control
Power point Presentation : Batteries

Books for Study:

1. Bard and Faulkner. (2001). *Electrochemical Methods*. 2nd edition, John Wiley and sons.
2. Bockris and Reddy. (2002). Modern Electrochemistry (Vol. II). 2nd edition, Kluwer academic publishers.
3. Jain and Jain. (2005). *Engineering Chemistry*. 15th edition, Dhanpat Rai Publishing Company.

Books for Reference:

1. Pletcher. (1990). *Industrial Electrochemistry*. 2nd edition, Chapmann and Hall.
2. Banerjee. (1985). *Introduction to the Science of Corrosion and its Inhibition*. Oxonian Press.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	M	M	L
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	S	H	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. M. Suganthi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY3E3**	**Major Elective -I Polymer Chemistry**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- The objective of the course is to stress the importance of polymers.
- To understand various polymerization techniques and characterization of polymers.
- To understand polymer structure, properties and to know the polymer processing techniques, and the chemistry of commercially available polymers and polymer additives.

Course Outcomes (CO)

K1	CO1	To learn the principles and concepts of contemporary polymer chemistry.
K2	CO2	To understand the basic concepts of polymer synthetic techniques.
K3	CO3	To Categorize the basic reactions in polymer chemistry.
K4	CO4	To Analyze the physical properties of different polymers and Characterize the polymers using various experimental techniques.

Unit-1

Types and Chemistry of Polymerization **13 Hrs**

Classification of polymers, Types of polymerization – addition, free radical, ionic and coordination polymerization – Ziegler-Natta, Stereo regular polymerization, Condensation polymerization – Mechanism and Kinetics of polymerization – degree of polymerization – kinetic chain length – *factors affecting chain polymerization*- inhibition and retardation – Carother's equation.

Unit-2

Copolymerization and Polymerization Techniques **13 Hrs**

Types of copolymers- ideal, alternating, block and graft copolymer – Types of copolymerization – Free radical ionic copolymerization – polycondensation – copolymer equation – significance – monomer and radical reactivity – Q-e scheme - Determination of monomer reactivity ratio – Mayo-Lewis and Fineman Ross methods – block and graft copolymerization – methods of preparation and mechanism.

Unit-3

Polymer Characteristics and Characterization **13 Hrs**

Types of degradation – thermal, mechanical and photo degradations – management of plastics in the environment. The concept of number average and weight averages. Molecular weight methods - Molecular weight distribution, separation of polymers – precipitation and analytical methods – *determination of molecular weights* – Osmotic pressure, light scattering, viscosity and end group analysis, ultra centrifugation methods.

Analysis and testing of polymers- physical / mechanical and chemical analysis of polymers – spectroscopic methods, x-ray diffraction study.

Unit-4

Structure, Properties and Fabrication of Polymers **13 Hrs**

Morphology and order in crystalline polymers – configurations of polymer chain – types of stereo isomerism in polymer – tacticity (eg. Mono and disubstitute polyethylene, polypropylene, polybutadiene) significance of stereoregularity.

Polymer structure and physical properties – crystalline melting point Tm – melting points of homogeneous series – effect of chain flexibility and heat of fusion. The glass transition temperature, Tg-relationship between Tm and Tg, effects of molecular weight, chemical structure, property requirements and polymer utilization.

Fabrications of polymers –Moulding, casting and spinning polymers.

Unit-5

Chemistry of Commercial Polymers and Polymer Additives **13 Hrs**

Organic polymers polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins. Dendrimers – Types and applications.

Inorganic polymers – silicon polymers, glass, poly (organophosphazenes) polymers, Basic concept of conducting polymers, liquid crystal polymer, biopolymer and biomedical polymer.

Polymer additives: Fillers, plasticizers, colourants, auto oxidants, fire retardants and thermal stabilizers – polymer blends and composites.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : Fabrications of polymers
Seminar : Copolymerization and Polymerization Techniques
Group discussion : Types of polymerization
Power point Presentation : Chemistry of Commercial Polymers

Books for Study:

1. Billmeyer, F. W. (1984) *Text book of polymer science*, 3rd Edition, John Wiley & Sons

2. Gowariker (V.R) & Viswanathan, N.V (1984) *Text book of Polymer science* 1st Edition, New Age International Private Ltd.

3. Introductory polymer chemistry, G.S. Misra, Wiley eastern Ltd

Books for Reference:

1. Text book of polymer science, F.W. Billmeyer Jr. 3rd Edn., Wiley, India 2007.
2. Principles of polymerization, George Odian, 4th Edn., John wiley and sons, 2007.
3. Polymer science and technology, Goel R. Fried, Prentice – Hall of India, New delhi,

2000.
4. Polymer science and technology of plastics and rubbers, P. Ghosh, Tata McGraw-Hill, New delhi, 1998.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	M	M	L
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	S	H	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. M. Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY311**	**Physical Chemistry –III**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To enable a comprehensive knowledge on Thermodynamics and non -ideal systems.
- To understand quantum statistics, Partition function and fundamentals of Surface chemistry.
- To apply the knowledge to develop new machineries.

Course Outcomes (CO)

K1	CO1	To remember the fundamentals of thermodynamics and surface chemistry.
K2	CO2	To understand the third law of thermodynamics and concept of fugacity and activity. To comprehend the quantum statistics and partition function. To know about fluorescence, phosphorescence, laser, maser and its applications.
K3	CO3	To apply the third law of thermodynamics and quantum statistics.
K4	CO4	To analyze the variation of fugacity with temperature and pressure, to interpret the mean activity and activity coefficient, to analyze the various quantum statistics in determination of probability.

Unit-1

Themodynamics and Non-ideal systems **13 Hrs**

Fugacity - determination of fugacity of gases by graphical method, approximate calculation method, generalized method and from equations of state. Variation of fugacity with temperature and pressure. Fugacity of a gas in a mixture of real gases - Lewis Randal rule.

Definition of activity - activity coefficient of a gas - relation between fugacity and activity coefficient of gas - variation of activity of a gas with temperature and pressure, activity and activity coefficient of solutions-mean activity and mean activity coefficient.

Unit-2

Third Law of Thermodynamics **13 Hrs**

Probability and third law - *need for third law* - Nernst heat theorem, thermodynamic quantities at absolute zero, helium at low temperature-negative absolute temperature - entropy of gases - entropy at absolute zero - entropy and probability (Boltzmann Expression) - Boltzmann - Planck equation - significance of thermodynamic probability - entropy of expansion of ideal gas.

Mathematical Introduction: Theories of permutation & combination - laws of probability - Gaussian distribution.

Unit-3

Statistical Thermodynamics **13 Hrs**

Introduction - combination and permutation laws – Macroscopic and microscopic probabilities- distinguishable and indistinguishable objects - Maxwell - Boltzmann statistics – Fermi-Dirac statistics-Bose-Einstein statistics- thermodynamic probability- thermodynamic probabilities of systems in equilibrium - Boltzmann expression for entropy - Stirling's approximation - States of maximum thermodynamics probability - Legrangian multipliers - Maxwell - Boltzmann distribution law - Evaluation of alpha and beta in M.B. distribution law.

Unit-4

Partition function **13 Hrs**

Partition function – canonical ensembles - Molecular partition function and canonical function - evaluation of translational, rotational and vibrational partition function – Evaluation of E, Cv and entropy from the partition functions - The relation between partition function and thermodynamic function (E, H, S, A, G, Cv and Cp) - study of monoatomic and diatomic ideal gas molecule on the basis of partition functions - ortho and para hydrogen.

Unit-5

Catalysis and Surface Chemistry **13 Hrs**

Catalysis- characteristics - acid-base catalysis - enzyme catalysis - Michaelis-Menten equation - effect of temperature on enzyme catalysis - heterogenous catalysis - kinetics of heterogeneous catalysis - Langmuir- Hinshelwood, Rideal - Eley mechanism - pH dependence of rate constants of catalyzed reactions - auto catalysis and oscillatory reactions.

Surface phenomenon - physisorption and chemisorptions - applications - factors influencing adsorption - adsorption isotherms: Langmuir, Freundlich, BET and Gibbs adsorption isotherm - measurement of surface area.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : Third law of thermodynamics

Group discussion **:** Surface Chemistry

Books for Study:

1. Puri B.R & Sharma. L R (2009), *Advanced Physical Chemistry*, 2nd Edition., Milestone Publishers & Distributors.
2. Bajpai, D.N. (1992), *Advanced Physical Chemistry,* S. Chand Publishing Limited.
3. Gupta, M.C. (1990), *Statistical thermodynamics,* Wiley Eastern Limited.
4. Rajaram Kuriacose (2006), *Statistical thermodynamics*, 4th edition, Shoban lal & Co.
5. Gurudeep Raj (2014). *Chemical Kinetics*, Krishna Educational Publishers.

Books for Reference:

1. Klotz, L. M, Rosenberg R.M. & Benjamin, W.A (1974), Chemical thermodynamics, 3rd Edition, Pearson publications.
2. Glasstone, (1964, Thermodynamics *for chemists*, 2nd Edition, Van Nostrands.
3. Nash, L.K. (1976, *Chemical Thermodynamics*, 2nd Edition, Addision Wesley Publishing.
4. Gabor A. Somorjai and Yimin Li (2010), *Introduction to Surface Chemistry and Catalysis 2nd Edition*, Willey Publishers.
5. Adamson, A.W.,"Physical Chemistry of Surfaces", Wiley, 6th edition, 1997

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	M	S	L
CO2	S	M	H	S	H
CO3	S	M	S	M	M
CO4	S	S	S	M	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY3E4**	**Major Elective - II Green, Nano Chemistry and Cyber Security**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	3	**Total Hrs:** 52	**Credits:**	3

Course Objective

- To stimulate students to have in-depth knowledge in green chemistry.
- To introduce the various type of greener reactions, materials.
- To acquire a clear idea about various synthesis of Nanomaterials and techniques.
- To know about literature review, writing a project etc.,

Course Outcomes (CO)

K1	CO1	To recollect the hazardous effect of chemicals and solvents used in laboratory.
K2	CO2	To understand the basic principles of green chemistry, to comprehend the importance of nanotechnology and to understand the fundamentals of nanotechnology. To get the idea about problem selection, literature review and project writing. To get the idea about cyber security.
K3	CO3	To apply the concept of green chemistry in synthesis.
K4	CO4	To review the preparation and experimental techniques of Nanomaterials.

Unit-1

Green Chemistry Principles & Greener Reactions **11 Hrs**

Definition, *need of green chemistry*, twelve basic principles of green chemistry - planning a green synthesis in a chemical laboratory - Atom efficient processes and atom efficiency, atom economy (with specific reaction).

Water as greener solvent- reactions in ionic-liquid, solvent free reaction - solid supported organic synthesis, phase transfer catalyst (PTC), use of microwaves and sonication (any four specific reactions with mechanism).

Unit-2

Preparation of Nano Structured Materials **11 Hrs**

Introduction- definition – types, *properties of nano materials*, Bottom up and Top down approaches - methods of preparation of nano materials - plasma arching, chemical vapour deposition, electrodeposition, sol-gel synthesis.

Experimental Techniques

Instrumentation, principle and applications of scanning electron microscopy (SEM), transmission electron microscopy (TEM), atomic force microscopy (AFM), scanning tunnelling microscopy (STM) and ESCA

Applications of Nanomaterials

Catalysis, environmental and biomedical (drug delivery) applications. Nanomaterials-environmental hazards.

Unit-3

Research Methodology **10 Hrs**

Problem selection- literature survey- primary sources - journals, patents, journals of different fields of chemistry (organic, inorganic, physical, polymer, analytical and nano) - secondary sources- books, indexes, chemical abstracts, review articles - literature searching online. E-journal, plagiarism, Intellectual property rights.

Writing a project report - dissertation - style and conventions - title, abstract, introduction, review of literature, experiments, results and discussion, foot notes, figures, presenting data, tables, summary and bibliography.

Unit-4

Over view of cyber security **10 Hrs**

Confidentiality, integrity and availability – **Threats:** Malicious software (viruses, Trojans, rootkits, worms, botnets), Memory exploits (buffer overflow, heap overflow, integer overflow, format string) – **Cryptography**- Authentication, password system- windows security.

Unit-5 **10 Hrs**

Network security: Network intrusion detection and prevention system, firewalls.

Software security: Vulnerability auditing, penetration testing, sandboxing, control flow integrity – **web security**: user authentication- **Legal and ethical issues:** Cyber crime, intellectual property rights, copy right, patent, trade secret, hacking and intrusion, privacy, identity theft.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment **:** Green chemistry
Seminar **:** Nano materials
Group discussion : Overview of cyber security

Books for Study:

1. Pradeep.T (2007), *Nano The Essentials*, McGraw Hill Education (India) Pvt.Ltd.
2. Pradeep.T (2012), *Text Book of Nano science and Nanotechnology*, McGraw Hill Education (India) Pvt.Ltd.
3. Kothari. C.R, *Research Methodology* (2004) New Age International (P) Limited.
4. Ahluwalia, V.K. & Kidwai. M, *New Trends in Green Chemistry* (2004), Springer Science &Business media.
5. Ahluwalia. V.K, *Green Chemistry (Environmental benign Reactions)* (2006), Ane Books Pvt. Ltd.
6. WM. Arthur Conklin, Greg White, TMH "Principles of Computer Security"

Books for Reference:

1. Poole C.P & Owns F.J. (2003), *Introduction to Nanotechnology* John Wiley & Sons.
2. Chwan- Hwa (John) Wu, J.David Irwin, Computer Networks & Cyber security (2016) CRC Press.
3. Mike O'Leary, Cyber O (2016) – Apress Publications
4. Jeff Kramer, Nicolas Burrus, Florian Editler, Matt Parker, "Hacking the Kinect", (2016), Technology in cation Publications.
5. Karkare. M. (2008). *Nanotechnology Fundamentals and Applications*. K. International Pvt. Ltd.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	L	L	L
CO2	S	H	H	L	M
CO3	S	H	L	L	L
CO4	S	H	H	M	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Dr. V.Prabhu & Ms. M.Anusuya Signature:	Name: Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY3E5**	**Major Elective – II Water Pollution and Industrial Effluents treatment**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	3	**Total Hrs:** 52	**Credits:**	3

Course Objective

- To stimulate students to have in-depth knowledge in water, air and soil pollutants.
- To create the awareness about various water treatment techniques and reduce the water pollution.

Course Outcomes (CO)

K1	CO1	To understand the essential role of water in industries and to preserve the same.
K2	CO2	To Acquire knowledge about Pollution of water and its Harmful effects
K3	CO3	To Understood complete physico chemical examination of water.
K4	CO4	To Recognize the industrial effluents and their treatment in brief.

Unit-1

Characteristics of Water **10 Hrs**

Introduction – sources of water – Hardness of water - Units of hardness – problems on calculation of hardness – Disadvantages of hard water – Scale and sludge formation in boiler – Boiler Corrosion - Softening methods – problems on softening – desalination of Brackish water: Distillation, Electro dialysis and reverse osmosis.

Unit-2

Water Pollution **10 Hrs**

Introduction – Definition of water pollution – water Pollutants – physical and chemical pollution of water – ground water pollution – harmful effects of ground water pollution – surface water. River water and sea water pollution, Oil pollution of water. Effects oil pollution in marine water – Radioactive materials in water.

Unit-3

Physico chemical Examination of water **11 Hrs**

Collection of samples – colour – odour Turbidity pH – temperature – Soilds: Total Solids, Dissolved solids, suspended solids, settable solids – Acidity – Free carbon dioxide – Alkalinity – Hardness – calcium, Magnesium, Sodium - Potassium - Iron – Aluminum – Sulphate – Silica – Heavy metal such as Arsenic, Calcium, chromium – copper – lead - Manganese – Mercury – Nickle – Selenium – Tin and Zinc – *Dissolved Oxygen, BOD, COD,* Permanganate value – Ammonia Nitrogen – Albuminoidal nitrogen – Total Kjeldhal Nitrogen etc.

Unit-4

Industrial Effluents **10 Hrs**

Pulp and paper industries Cotton Processing – Cane sugar industry - Distillery – Dairy– Iron production. Electroplating in industry – oil field and oil refinery – Fertilizer industry - Pesticide manufacture - Rubber wastes –Slaughter House and Meat packing – Soaps and Detergents manufacture - Soft Drinks Manufactures. Viscose rayon Manufacture – *Radioactive Pollution.*

Unit-5 **11 Hrs**

Treatment of Industrial Effluents

Primary Treatment: Screening – Sedimentation – Equalization – Neutralization – Coagulation. Secondary Treatment: Aerated Lagoons – Trickling Filtration – Activated sludge process – Oxidation. Ditch – Oxidation Ponds - Anaerobic digestion. Tertiary Treatment: Evaporation – Reverse osmosis – Dialysis – Ion Exchange – chemical precipitation Activated Carbon Treatment. Tolerance limits for Industrial Effluents.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment **:** Oil pollution of water
Seminar : Water Pollution
Group discussion : Harmful effects of water pollution

Books for Study:

1. Agarwal. S.K. (2005) *Water Pollution*, APH Publishing.
2. Chakrabarty, B.N. (1981) *Industrial Chemistry*, Oxford & IBH Publishing Co., New Delhi.
3. Singh, P.P. Joseph, T.M. Dhavale, R.G (1983) *College Industrial Chemistry*, Himalaya Publishing House, Bombay, 4th Edition
4. De. A.K. (1989) *Environmental Chemistry*, 11th Edition, Wiley Eastern Ltd. Meerut

Books for Reference:

1. Mukhlyonov. I(1979) *Chemical Technology*, Moscow, 3rd Edition. Mir publication
2. Norris Shreve. R &. Brink, J.A (1977) *Chemical Process Industries.* 4th Edition. McGraw Hill, Tokyo.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	L	L	L
CO2	S	H	H	L	M
CO3	S	H	L	L	L
CO4	S	H	H	M	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Dr. V.Prabhu & Ms. M.Anusuya Signature:	Name: Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY3E6**	**Major Elective - II Nano Technology And Supramolecular Chemistry**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	3	**Total Hrs:** 52	**Credits:**	3

Course Objective

- To understand knowledge on application of nanomaterials.
- To apply nanodevices as sensors
- To provide a concise introduction and applications of supramolecular chemistry.

Course Outcomes (CO)

K1	CO1	To understand about characteristic of Sensors and Energy devices in Nanotechnology.
K2	CO2	To learn about the synthesis and structure of supra molecules, supramolecular interactions and applications.
K3	CO3	To analyze the multiple H-bonding interactions used in crystal engineering
K4	CO4	To apply supramolecular chemistry in appropriate fields.

UNIT I

Sensors **10 Hrs**

Static and Dynamic Characteristics - Inorganic Nanotechnology Enabled Sensors - Gas Sensing with Nanostructured Thin Films - Nanotechnology Enabled Mechanical Sensors - Nanotechnology Enabled Optical Sensors - Magnetically Engineered Spintronic Sensors - Organic Nanotechnology Enabled Sensors - Surface Materials and Surface Modification.

UNIT II

Energy Devices **10 Hrs**

Nanoscale Electronic and Ionic Transport – Energy Conversion and Storage in Electrochemistry - Overview of the Principles of Operation of Energy Conversion and Storage Devices - Solar Cells -Nanomaterials and Nanostructured Films as Electro active Electrodes - Nanomaterials as Electrolytes - Lithium Ion Batteries - Fuel Cells. *Quantum Dot Sensitizers.*

UNIT III

Introduction to Supramolecular Chemistry **11 Hrs**

Definition of supramolecular chemistry. Nature of binding interactions in supramolecular structures: ion-ion, ion-dipole, dipole-dipole, H-bonding, cation-p, anion-p, p-p, and van der Waals interactions.

Relevance of supramolecular chemistry to mimic biological systems: cyclodextrins as enzyme mimics, ion channel mimics, supramolecular catalysis etc.

UNIT IV

Synthesis and structure **10 Hrs**

Synthesis and structure of crown ethers, lariat ethers, podands, cryptands, spherands, calixarenes, cyclodextrins, cyclophanes, cryptophanes, carcerands and hemicarcerands., Host-Guest interactions, pre-organization and complimentarity, *lock and key analogy*. Binding of cationic, anionic, ion pair and neutral guest molecules.

UNIT V

Supra molecular assembly and Devices **11 Hrs**

Self-assembly molecules: design, synthesis and properties of the molecules, self assembling by H-bonding, metal-ligand interactions and other weak interactions, metallomacrocycles, catenanes, rotaxanes, helicates and knots. Crystal engineering: role of H-bonding and other weak interactions.

Molecular devices: molecular electronic devices, molecular wires, molecular rectifiers, molecular switches, molecular logic.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment **:** Sensors
Seminar **:** Synthesis and structure of supra molecules
Group discussion : Molecular devices

Books for Study:

1. Pradeep,T (2008): Nano: The Essentials: Understanding Nanoscience and Nanotecnology Tata McGraw-Hill Publishing Company Limited, New Delhi.

2. J.-M. Lehn; Supramolecular Chemistry-Concepts and Perspectives (Wiley-VCH,1995)

3. P. D. Beer, P. A. Gale, D. K. Smith; Supramolecular Chemistry (Oxford University Press,1999)

Books for Reference:

1. Rao,C. N. R, Thomas,P. J. andKulkarni,G. U (2007): Nanocrystals: Synthesis, Properties and Applications, Springer .

2. Kourosh Kalantar-zadeh and Benjamin Fry (2008): Nanotechnology - Enabled Sensors,Springer.

3. Guozhong Gao (2004): Nanostructures & Nanomaterials: Synthesis, Properties & Applications, ImperialCollegePress .

4. J. W. Steed and J. L. Atwood; Supramolecular Chemistry (Wiley, 2000)

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	L	L	L
CO2	S	H	H	L	M
CO3	S	H	L	L	L
CO4	S	H	H	M	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Ms. R. Mini Ms. M.Anusuya Signature:	Name: Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY412**	**Inorganic Chemistry - III**	**Batch :**	2019-2021
			Semester	IV
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To allow the students to get introduced to the study of inner transition elements.
- To acquire knowledge in the nature, preparation and properties metal carbonyl complexes, photochemistry of metal complexes and various applications and the role of metals in biological systems.

Course Outcomes (CO)

K1	CO1	To remember the general properties of lanthanides and actinides.
K2	CO2	To understand the magnetic properties of lanthanides and actinides. To comprehend the homogeneous catalysis of organometallics. To get the idea about inorganic photochemistry, mechanism involved in organometallics. To understand the importance of biological function of certain metals.
K3	CO3	To apply catalytic property of organometallics in synthesis.
K4	CO4	To analyze the mechanism involved in organometallics and the biological function of certain metals.

Unit-1

Chemistry of Inner transition elements **13 Hrs**

Color and complex formation inner transition elements- comparison between 'd' and 'f' block elements - magnetic properties of Lanthanides and Actinides - complex formation and color absorption spectra of lanthanides and actinides. Comparison between lanthanides and actinides - Use of lanthanide compounds as shift reagents.

Unit-2

Homogeneous catalyst by organometallics **13 Hrs**

Types of reactions in Homogeneous catalyst - olefin hydrogenation, olefin dimerization and metathesis, Monsanto acetic acid synthesis, olefin isomerization, Wacker oxidation of alkenes, hydroformylation, water gas shift reaction, template synthesis, alkene hydrosilation, acetic acid from ethylene. Zeise's salt, Vaska complexes. Heterogeneous catalysis - Zieglar-Natta Catalysis.

Unit-3 **13 Hrs**

Inorganic Photochemistry

Introduction, $[Ru(bipy)_3]^{2+}$ complexes in solar energy, Photochemical reactions of metal carbonyls, Photolysis of water. Photochemistry of metal beta diketonates.

Insertion reaction- Introduction - CO insertion and SO_2 insertion reactions - insertion involving alkenes.

Oxidative addition and reductive elimination- Introduction, one-electron oxidative addition-addition of oxygen-mechanism, 5-coordinate 18-electron reactants, 4-coordinate 16-electron reactants, 4-coordinate 18-electron reactants, concerted Vs free radical mechanism, reductive elimination.

Unit-4

Bioinorganic chemistry:I **13 Hrs**

Essential and non-essential elements, Biochemistry of Sodium and Potassium - The Sodium-Potassium pump - Biochemistry of Calcium-Storage and transport of Calcium-Calmodulin-Muscle constaction and blood clotting-Biochemistry of Copper- Stuctural features of different Copper proteins- Storage and transport of Copper, Biological Function and toxicity of Some Elements (Cr, Mn, Co, Ni, Se, Mo, Cd, Pb).

Unit-5

Bioinorganic Chemistry:II **13 Hrs**

Metalloporphyrins (heme and non-heme proteins) - cytochromes, heomoglobin, myoglobin, chlorophyll, ferridoxins, rubredoxins - Vitamin B_{12} and B_{12} coenzymes (structure and functions) - nitrogen fixation (invitro and invivo) - Metallo enzymes - Carboxypeptidase, Cytochrome-P-450 and Carbonic anhydrase- Metallo drugs for cancer theraphy (Cis-platin).

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment **:** homogeneous catalysis by organometallics
Seminar **:** Chemistry of non-transition elements
Group discussion : Biological function of elements

Books for Study:

1. Gurdeep Raj. (2014). *Advanced Inorganic Chemistry*. 12th Edition. Geol Publishing House
2. Madan. R.D. (2011). *Advanced Inorganic Chemistry*. 3rd Edition. S. Chand & company, New Delhi.
3. Malik, U.K, Tuli, G.D & Madan, R.D (2010) *Selected Topics in Inorganic Chemistry*, S. Chand Publication.
4. Asim K. Das. (2015). *Bio-inorganic chemistry*. Books and Allied Pvt. Ltd.
5. Lehinger. ( ) *Bio-inorganic chemistry*.

Books for Reference:

1. Keith F. Purcell, John. C. Kotz. (1997). *Inorganic chemistry*, Holt- Saunders International Editions.
2. James E. Huheey. (1993). *Inorganic Chemistry*, Fourth edition, HarperCollins College Publishers. (Units I, II, III, IV)

3. Basolo, F. & Pearson. R.G. (1967) *Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution.* Wiley Eastern Limited.
4. Ivano Bertini, Harry B. Gray, Stephen J.Lippard, and Joan Selverstone Valentine. (1998). *Bioinorganic Chemistry*, VIVA books private Ltd. (Units III, IV).

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
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CO2	S	L	M	M	M
CO3	S	L	H	L	S
CO4	S	M	H	L	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY4E7**	**Major Elective -III Medicinal Chemistry**	**Batch :**	2019-2021
			Semester	IV
Hrs/Week:	4	**Total Hrs:** 60	**Credits:**	3

Course Objective

- The course is to enable students to understand drug actions.
- To learn chemistry of various types of drugs such as antibiotics, analgesics, antipyretics, cardiovascular, anti-tubercular drugs, antihistamines and antimalarials.

Course Outcomes (CO)

K1	CO1	Outline the physicochemical properties of drugs
K2	CO2	Describe drug absorption, distribution, metabolism and excretion
K3	CO3	To synthesize and study novel Antibiotics for future generations
K4	CO4	Formulate the synthesis of few important drugs such as analgesics, antipyretics, cardiovascular, anti-tubercular drugs, antihistamines and antimalarials

Unit-1

Drug action and sulpha drugs **12 Hrs**

Physiochemical properties in relation to biological action - influence of route of administration. Biotransformation-absorption from stomach -absorption from intestines –sites of loss -metabolism and excretion, *harmful drugs and their side effects*.

Sulpha drugs -sulphathiazole, sulphamerazine, sulphaguanidine and other sulpha drugs,-synthesis, mechanism of action -uses.

Unit-2

Antibiotics **12 Hrs**

Antibiotics -A study of Chloramphenicol, Penicillin - semisynthetic Penicillin -gross structural features Streptomycin-Cephalasporin, *Erithromycin*, *Chloromycetin* and Tetracycline.

Polyene antifungal antibiotics-nystatin, fusicidic acid-*griesofulvin*. (gross structural features not needed).

Unit-3

Analgesics and antipyretics **12 Hrs**

Study of morphine-structure activity relationship (SAR)-morphine analogues – Codeine -synthetic analgesics- pethidines and methadones -narcotic antagonist.

Antipyretic analgesics - salicylic acid, pyrazole and para amino phenol derivatives. Sedatives:- -Barbiturates, Benzodiazepines.

Unit-4

Cardio Vascular and anti-tubercular drugs **12 Hrs**

Cardio Vascular Drugs -classification, cardiac glysocides, anti-hypertensive and hypotensive agents -mode of action –anti-arythamic agents.

Anti-tubercular drugs -sulphanamides -sulphones, p-amino salicylic acid -INH - ethambutal, *Rifampicin*.

Unit-5

Anti-histamines and anti-malarials **12 Hrs**

Anti-histamines-introduction -mode of action of anti-histamines - SAR -ethylene diamine, ethanol amine, propyl amine and –cyclizine derivatives -synthesis.

Anti-malarials-classification -quinine, 4-amino and 8-amino quinolines and pyrimidines.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : Anti-malarials
Seminar : Analgesics and antipyretics
Group discussion : Cardio Vascular Drugs
Power point Presentation : Drug action and sulpha drugs

Books for Study:

1. Patric, G. L. (2005), An Introduction to Medicinal Chemistry. 3rd ed, Oxford University Press.

2. Silverman, R. B. (2004), The Organic Chemistry of Drug Design and Drug Action. 2nd ed, Academic Press.

3. Williams, D. A.; Lemke, T. L. (2006), Foye's Principles of Medicinal Chemistry. 5th ed. Wolters Kluwer Health (India) Pvt. Ltd.

Books for Reference:

1. A. Burger, (1990), Medicinal Chemistry, Vol - I and II, Wiley inter Science, New York.
2. O. Wilson, O. Giswold and F. George, (1991), Text book of organic, Medicinal and Pharmaceutical Chemistry, Lippincott Company, Philadelphia, 9th Edn.
3. Bentley and Driver, Text book of Pharmaceutical Chemistry.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
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CO2	S	S	M	S	S
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S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Ms. R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY4E8**	**Major Elective - II Food Science and Technology**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	4	**Total Hrs:** 60	**Credits:**	3

Course Objective

- To enable the students understand the effect of various methods of processing on the structure and composition of food materials
- To identify different cooking methods and common adulterants in foods.

Course Outcomes (CO)

K1	CO1	To understand the outlines of cereal and pulse processing technology.
K2	CO2	To appreciate the importance of nutrients in milk, fruits and vegetables.
K3	CO3	To comprehend the nutritive value of fleshy foods.
K4	CO4	To recognize the composition of sugar, spices, nuts and oilseeds.

Unit I

Physico-chemical properties of foods **12Hrs**

Moisture in Foods, Hydrogen Bonding, Bound Water, Water Activity in Foods, Determination of Moisture Content in Foods, True Solutions, Dispersions, Sols, Gels, Foams, Colloids and Emulsions

Cereals and millets

structure, nutritive value, processing outlines of some common cereals (rice, wheat). Pulses: structure and composition of pulses, toxic constituents in pulses, processing of pulses-soaking, germination, Malting.

Unit II

Vegetables, Fruits and Milk **12Hrs**

Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments. Milk and milk products, composition, nutritive value, properties, processing of milk.

Unit III

Fleshy Foods **12Hrs**

Egg: structure, composition, nutritive value, measures of quality. Meat: Structure, composition, classification, nutritive value, tenderization and curing of meat; Poultry:

composition, classification, nutritive value and processing; Fish: composition, classification, nutritive value.

Unit IV

Sugar, Fats and Oil Seeds **12Hrs**

Sugar - composition, nutritive value, stages of sugar boiling. Nuts and oilseeds: classification, composition, nutritive value, uses of nuts and oilseeds. Spices and condiments: types, functions and uses.

Unit V

Methods of cooking **12Hrs**

Moist heat, dry heat and fat as a media of cooking, merits and demerits. Food adulteration, detection, control of common food adulterants.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment **:** Cereals and millets
Seminar **:** Sugar, Fats
Group discussion : Methods of cooking

Books for Study:

1. Shakuntala Manay, Shadaksharaswamy. M (2017) Foods, Facts and Principles, New Age International Pvt Ltd Publishers, 2nd Edition
2. Chandrasekhar, U. Food Science and applications in Indian Cookery (2002) Phoenix Publishing House, New Delhi
3. Swaminathan, M. Food Science, (2015) Chemistry and Experimental Foods, Bappco Publishers, Bangalore.

Books for Reference:

1. B. Srilakshmi, (2015). Food Science.New age International P. Ltd, New Delhi.

2. McWilliams(2007). Food Fundamentals, John Willey and sons, New York.

3. S. N. Mahindru (2009). Food Science and Technology, Hardbound P.Ltd, New Delhi.

4. Norman N. Potter (2009). Food Science,FifthEdition, Springerlink, Newyork.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
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S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Dr. M. Suganthi Ms. R. Mini Signature:	Name: Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY4E9**	**Major Elective - III Dye Chemistry**	**Batch :**	2019-2021
			Semester	III
Hrs/Week:	4	**Total Hrs:** 60	**Credits:**	3

Course Objective

- To stimulate students to have in-depth knowledge in Dye chemistry.
- To design dyes into reusable or degradable dyes.
- To motivate the students to design eco friendly dyes for future generation.

Course Outcomes (CO)

K1	CO1	To understand the chemistry of dyes
K2	CO2	To interpret the various types of dyes, synthesis, reactions and applications
K3	CO3	To recognize the pigments, cosmetics and colouring agents
K4	CO4	To synthesize new dyes for the sustainable development using green chemistry principles.

Unit-1

Colour and Constitution **12 Hrs**

Relationship of colour observed to wavelength of light absorbed – Terms used in colour chemistry – chromophores, *Auxochromes*, *Bathochromic shift*, Hypsochrmic shift. Quinonoid theory and modern theories: Valence bond theory, molecular orbital theory.

Unit-2

Chemistry of organic intermediates used in dye manufacture. **12 Hrs**

Benzene, Naphathalene and Anthroqucnone intermediates. *Nitro dyes*, Nitrosodyes, Azo dyes – principles governing azo coupling – mechanism of diazotization coupling with amines, coupling with phenols. Classification according to the number of azo groups and application – Tautomerism in azo dyes.

Unit-3 **12 Hrs**

Synthesis of specifics dyes and uses

Orange IV, Diamond Block F, Metanil yellow, Tartrazines Direct Deep Black, Eriochrome Black T, Eriochrome Red B, Cellition Scarlet B, Congo Red, Malachite green, methylene blue, Safranine – T, Acid Magenta, Cyanin Green G, Alizarine, Benzanthrone, Indigo, Copper phthalo cyanine, Sulphur black – T .

Unit-4 **12 Hrs**

Synthesis, reactions and applications of dyes

Xanthene dyes, Cyanine dyes, acridine dyes, Sulphur dyes, Anthranquinone dyes: Anthraquinone mordant dyes, Anthroquinone acid dyes and Anthraqyinone disperse dyes. Eco friendly pigments for sustainable development.

Unit-5 **12 Hrs**

Pigments

Introduction -*Requirements of organic pigments*, Types of Pigments – Applications. Eco friendly approach. Fluorsecent. Brightening agents – application of dyes in other areas, – Leather, paper, medicine, chemical analysis, cosmetics, colouring agents Food and Beverages.

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment **:** Application of dyes
Seminar **:** Synthesis, reactions and applications of dyes

Group discussion : Colouring agents in Food

Books for Study:

1. Gurdeep R Chatwal, Synthetic Dyes, Published by Himalaya Publishing House.
2. Venkataraman, The chemistry of synthetic dyes volume I, Ademic Press Jnc, Publishers, New York.
3. B.K. Sharma, An introduction to industrial chemistry. Krishna publications.

Books for Reference:

1. Finar, I.L. (2002) *Organic Chemistry. Vol.1*. 5th Edition. Pearson India Ltd.
2. Jerry March (2007) *Advanced organic chemistry*. 4th Edition, A Wiley-Interscience.
3. Morrison, R.T, Boyd, R.N (2013) *Organic Chemistry*.7th Edition. Pearson India Ltd.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
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CO2	S	H	H	L	M
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S-Strong; H-High; M-Medium; L-Low

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Name: Dr.K.Poonkodi Dr. M. Suganthi Dr. V. Prabhu Signature:	Name: Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY413**	**Physical methods in Chemistry**	**Batch :**	2019-2021
			Semester	IV
Hrs/Week:	5	**Total Hrs:** 65	**Credits:**	5

Course Objective

- To introduce the principles of error analysis to the students.
- To enable the students to attain knowledge on various chromatographic techniques and thermo analytical methods.
- To gain knowledge in ESR, Mossbauer spectroscopy and AAS, AES, Polarimetry and Photo Electron Spectrometry.

Course Outcomes (CO)

K1	CO1	To remember the various analytical methods.
K2	CO2	To understand the analysis of data. To comprehend the basic principle, instrumentation and applications of various chromatographic techniques, thermal analysis. To understand basic principle, instrumentation and applications of photoelectron spectroscopy, AAS, FES, electron spin resonance and Mossbauer spectroscopy. To know about polarimetry.
K3	CO3	To apply data analysis, various chromatographic techniques to separate the compounds. To apply electron spin resonance and Mossbauer spectroscopy.
K4	CO4	To interpret the data in chemical analysis.

Unit-1

Data Analysis **13 Hrs**

Errors and classification in chemical analysis, defining terms: mean, median, accuracy and precision, improving accuracy of analysis - mean, standard deviation and Q-test, comparison of results - least square, t-test, f-test and chi square test, P-value, levels of confidence and significance, population and sample and reproducibility of measurements

Analysis of variance (ANOVA)- Correlation and Regression - curve fitting , fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals - general polynomial equation fitting , linearizing transformations, exponential function fit - r and its abuse - multiple linear regression analysis, elementary aspects.

Unit-2

Chromatographic methods **13 Hrs**

Solvent extraction - Methods of extraction and applications of solvent extraction. Solid phase extraction - methods and applications - chromatography - *thin layer chromatography*, ion exchange chromatography and size exclusion chromatography, HPLC - outline study of instrument modules. UPLC, UHPLC and HPLC-Mass spectroscopy, LCMS.

Gas chromatography - basic instrumental set up - carriers, columns, detectors and comparative study of TCD, FID, ECD and NPD.

Unit-3 **13 Hrs**

Thermal analysis

Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) and Thermometric titrations - basic principles, Instrumentation and application.

Atomic absorption spectroscopy and Flame emission spectroscopy

Basic principles - Instrumentation and applications.

Photoelectron Spectroscopy

ESCA (XPS): principle, chemical shifts - description of ESCA spectrometer, X-ray sources, samples, analysis, detectors and recording devices, applications, Auger electron spectroscopy (AES) and UV photo electron spectroscopy (UPS) - principles, applications and instrumentation.

Unit-4 **13 Hrs**

Electron spin resonance

Theory - derivative curves -'g' values, Kramer's degeneracy - zero field splitting - hyperfine splitting - isotropic and anisotropic systems - identification of free radicals (CH_3 and C_6H_5 radicals, Copper complex) - applications.

Mossbauer spectroscopy

Principle and theory- Doppler effect, Isomer shift - quadruple interactions - magnetic interactions – applications.

Unit-5 **13 Hrs**

Polarimetry

Circular Dichroism and Optical rotatory dispersion -Basic principles of ORD and CD - Cotton effects - Octant rule - axial halo ketone rules - applications of ORD and CD.

Molecular fluorescence and phosphorescence

Fluorescence and phosphorescence - principles of Fluorometers -Phosphorometers and their applications

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Assignment : Data analysis
Seminar **:** Chromatographic methods
Power point Presentation : ESCA

Books for Study:

1. Gurdeep R. Chatwal & Anand, S.K. (2003) *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House.
2. Sharma, B.K. (1999) *Instrumental methods of Chemical analysis*, 18th Edition. Goel Publishing house.
3. Ghosh, Introduction to Photoelectron Spectroscopy.

Books for Reference:

1. Skoog, D.A. West, D.M, Holder F.J & Grouch, S.R (2000) *Analytical chemistry an Introduction*, 6th Edition, Saunders College publishing.
2. Willard, H.H, Merrit L.L & Dean, J.A (2002). *Instrumental method of analysis*, 7th Edition, CBS Publishers & Distributors.
3. Drago, R.S (1964) *Physical methods in Inorganic chemistry*, 1st Edition, W. B. Saunders Company.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	M	M
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. M. Suganthi, Dr.V.Prabhu Ms. R.Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY414**	**Inorganic Chemistry Practical -II**	**Batch :**	2019-2021
			Semester	III &IV
Hrs/Week:	4&4	**Total Hrs:** 112	**Credits:**	3

Course Objective

- To know and apply the principle of complexometric titration.
- To get an idea about the quantitative analysis of mixture of cations using volumetric and gravimetric principles.
- To allow the students to know and practice the techniques in preparation of some inorganic complexes.

Course Outcomes (CO)

K3	CO1	To keep in mind the procedure of titration. To recollect the preparation of coordination compounds. To remember the analysis of cations.
K4	CO2	To understand the analysis of complexometric titration. To get the idea about preparation of coordination compounds. To understand the analysis of mixture of cations using volumetric and gravimetric titration.
K5	CO3	To estimate the cations using complexometric titration. To prepare coordination compounds by single stage preparation. To estimate the amount of individual cations present in a mixture using volumetric and gravimetric technique.

A. Titrimetry:

Complexometric titration involving EDTA.

Estimation of Calcium, Magnesium, Nickel, Zinc

B. Quantitative estimation:

Mixture of cations involving volumetric and gravimetric estimation:

Copper & Nickel, Iron & Nickel, Calcium & Copper and Calcium &Barium.

Books for Reference:

1. Venkateswaran, V. Veeraswamy. R and. Kulandaivelu, A.R (1997) *Principles of Practical Chemistry* 2nd Edition Sultan Chand & Sons.
2. Giri. S, Bajpai. D.N and Panday O.P (1997). *Practical Chemistry* Vol. I & II, S.Chand & Co.
3. Bassart J. Dennay. R.C. Jeffery G.H. and Mendham (2004). *Vogel's text Book of qualitative Inorganic Analysis,* 4th Edn. The ELBS & Longman.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	L	L
CO2	S	S	S	S	M
CO3	M	S	S	S	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY415**	**Organic Chemistry Practical -II**	**Batch :**	2019-2021
			Semester	III &IV
Hrs/Week:	3&4	**Total Hrs:** 91	**Credits:**	3

Course Objective

- To attain knowledge in estimating organic compounds quantitatively.
- To learn and practice the methods of preparation of some organic compounds.
- To understand some chromatographic techniques.

Course Outcomes (CO)

K3	CO1	To remember aromatic substitution reactions. To recollect the basic principles of various chromatographic techniques.
K4	CO2	To understand the estimation of phenol, aniline, ketone and glucose. To know about the preparation of organic compounds involving two stage preparation. To know about the extraction and estimation of certain natural product. To know the analysis of oil. To understand the chromatographic techniques.
K5	CO3	To estimate the amount of organic compounds present in the given solution. To prepare, recrystallise and report various organic compounds. To extract and estimate certain natural products. To separate the compounds using chromatographic technique.

A. Quantitative estimations:

1.Estimation of phenol, aniline, ethyl methyl ketone, Glucose (iodimetry method and Bertrand's method).

2. Citric acid or ascorbic acid from a tablet or from a natural source

B. Two stage preparations:

1. Benzanilide from benzophenone

2. Acetyl salicylic acid from methyl salicylate

3. Preparation of m- nirtrobenzoic acid from methyl benzoate

4. Preparation of p- nitroaniline from acetanilide

5. Preparation of p-bromo acetanilide from aniline

C. Extraction: (Not for ESE examination**)**

1. Lactose from milk

2. Caffeine from tea

3. Curcumin from *Curcuma longa*

4. Nicotine from tobacco extract

5. Citric acid or ascorbic acid from a tablet or from a natural source.

D. Analysis of oil: (Not for ESE examination)

Reichart-Meisel value, saponification value and acetyl value.

E. Chromatography:

Column, Paper and thin layer.

Books for Reference:

1. Day. B.B and Sitaram M.V and Govindachari T.R (1999). *Laboratory Manual of Organic Chemistry*, Allied Publishers Limited.
2. Gnanprakasam and Ramamurthy (2000). *Organic Chemistry Laboratory Manual* Ananda Book Depot, Chennai.
3. Jagmohan (2004). *Advanced Practical Organic Chemistry* Vol. I & II.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	M	L	L
CO2	S	S	H	S	S
CO3	M	S	H	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY416**	**Physical Chemistry Practical -II**	**Batch :**	2019-2021
			Semester	III &IV
Hrs/Week:	3&4	**Total Hrs:** 104	**Credits:**	4

Course Objective

- To arm the future chemist with the knowledge of electrical conductance measurement and conductometric titrations.
- To gain knowledge to make and record observations on conductometric titrations and chemical kinetics.

Course Outcomes (CO)

K3	CO1	To remember the definition of electrical conductance. To recollect the concept of conductometric titration. To keep in mind the acid hydrolysis of ester. To recollect the fundamentals of adsorption.
K4	CO2	To understand various laws of electrochemistry and applications of electrical conductance measurements. To know about the estimation of amount of ions condutometrically. To know about the applications of chemical kinetics and to understand the adsorption process.
K5	CO3	To determine the cell constant. To verify Debye-Huckel Onsager equation and Kohlrausch's law. To determine the solubility product. To estimate the amount of ions present in the solution conductometrically. To determine the relative strength of acids and rate of reaction. To determine the amount of oxalic acid adsorbed using charcoal as adsorbant.

Electrical Conductance measurements

1. Determination of cell constant
2. Verification of Debye-Huckel Onsager equation
3. Ostwald's dilution law
4. Verification of Kohlrausch's law
5. Solubility Product of sparingly soluble salt

Conductometric Titrations: *Acid-Base titrations*

6. Strong Base Vs Weak Acid
7. Strong Base Vs Mixture of (weak and strong) Acids

Precipitation titrations

8. $AgNO_3$ Vs mixture of halides (KCl & KI)
9. $BaCl_2$ Vs $MgSO_4$
10. Buffer Vs Strong acid

Chemical Kinetics

11. Acid hydrolysis of an ester - Relative strength of acids
12. Reaction kinetics of KI and $K_2S_2O_8$
13. Iodination of acetone

Adsorption

14. Adsorption of oxalic acid on charcoal

Books for Reference:

1. Palit S.R. and De S.K (2003). *Practical Physical Chemistry*, Science Book Agency, Calcutta.
2. Sharma P.C. and Agarwal (1998). *Practical Chemistry*,
3. Goel Publishing House, Meerut.
4. Venkateswaran and Kulaindaivelu (2005). *Practical Physical Chemistry* S. Chand & Co.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	M	L	L
CO2	S	S	H	S	M
CO3	M	S	S	S	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**19PCY420**	**Project Work & Viva-Voce**	**Batch**	2019-2021
			Semester	III &IV
Hrs/Week:	2&3	**Total Hrs:** 65	**Credits:**	7

Course Objective

- To arm the future chemist with the knowledge of research in various fields.
- To gain knowledge about different steps of research and article publications.

Course Outcomes (CO)

K3	CO1	To apply the various preliminary skills in laboratory
K4	CO2	To analyse the various sources of literature review
K5	CO3	To evaluate the various techniques from the previous studies and to apply the suitable parameters in the project work.

Note:- The Project work dissertation evaluation and viva-voce examination will be Conducted jointly by the Internal and External Examiners.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Dr.M.Durairaju Signature:	Name:Dr.Muthukumaran Signature:

PG DEPARTMENT OF CHEMISTRY

SYLLABUS

2020-2022 BATCH

FACULTY MEMBERS

Dr. K. POONKODI, M.Sc., M.Phil., Ph.D.

Dr. V. PRABHU, M.Sc., Ph.D.

Ms. K.VIMALADEVI, M.Sc., M.Phil., (Ph.D)

Ms. R. MINI, M.Sc., M.Phil., (Ph.D)

Ms. M. ANUSUYA, M.Sc., M.Phil., (Ph.D)

NALLAMUTHU GOUNDER MAHALINGAMCOLLEGE (Autonomous)
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Website: www.ngmc.org

Nallamuthu Gounder MahalingamCollege

Vision

Our dream is to make the college an institution of excellence at the national level by imparting quality education of global standards to make students academically superior, socially committed, ethically strong, spiritually evolved and culturally rich citizens to contribute to the holistic development of the self and society.

Mission

Training students to become role models in academic arena by strengthening infrastructure, upgrading curriculum, developing faculty, augmenting extension services and imparting quality education through an enlightened management, committed faculty who ensure knowledge transfer, instill research aptitude and infuse ethical, cultural values to transform students into disciplined citizens in order to improve quality of life.

PG DEPARTMENT OF CHEMISTRY

Vision

An effective Teaching – Learning adjunct to cater the need of industry in the context of the developing needs of the country.

Mission

The Chemistry Department pledges itself to encourage in the broadest and most liberal manner, the advancement of science and particularly chemistry in all of its branches through its education, research, and service missions.

SCHEME OF EXAMINATION

SEM	Course Code	Title of the Paper	Instruction hours/ week	Contact Hours	Examination				Credits
					Hours	CIA	ESE	Total	
I	20PCY101	Inorganic Chemistry –I- Solid state and Nuclear Chemistry	5	65	3	30	70	100	4
	20PCY102	Organic Chemistry – I- Reactions and Mechanisms	5	65	3	30	70	100	5
	20PCY103	Physical Chemistry –I- Group Theory and Chemical Kinetics	5	65	3	30	70	100	5
	20PCY207	Inorganic Chemistry Practical-I	5	--	--	--	--	--	--
	20PCY208	Organic Chemistry Practical-I	5	--	--	--	--	--	--
	20PCY209	Physical Chemistry Practical -I	5	--	--	--	--	--	--
Total									**14**
II	20PCY204	Inorganic Chemistry –II- Coordination and Organometallic Chemistry	5	65	3	30	70	100	5
	20PCY205	Organic Chemistry-II –Organic Reactions andStereochemistry	4	52	3	30	70	100	5
	20PCY206	Physical Chemistry-II – Quantum and Electrochemistry	5	65	3	30	70	100	5
	20PCY2E1 20PCY2E2	*Major Elective –I – Applied Electrochemistry (or) Food Science and Technology	3	39	3	30	70	100	3
	20PCY2N1/ 20PCY2N2	*Non-Major Elective: Chemistry in mankind (or) Chemistry in context	1	13	3	--	100	100	2
	20PCY207	Inorganic Chemistry Practical -I	4	117	6	40	60	100	3
	20PCY208	Organic Chemistry Practical-I	4	117	6	40	60	100	3
	20PCY209	Physical Chemistry Practical -I	4	117	6	40	60	100	4
Total									**30**

SEM	Course Code	Title of the Paper	Instruction hours/ week	Contact Hours	Examination				Credits
					Hours	CIA	ESE	Total	
III	20PCY 310	Organic Chemistry –III – Natural Products and Organic Reagents	5	65	3	30	70	100	5
	20PCY311	Physical Chemistry –III – Thermodynamics and Catalysis	5	65	3	30	70	100	5
	20PCY312	Spectroscopic Techniques – Application in Organic Chemistry	5	65	3	30	70	100	5
	20PCY3E3 20PCY3E4	*Major Elective -II – Research Methodology & Cyber Security (or) Industrial Chemistry	3	39	3	30	70	100	3
	20PCY3AL (Advanced learners)	Advanced functional materials	Self - study	--	2	--	100	100	3
	20PCY313	Internship	-	--	--	--	--	--	Grade
	20PCY417	Inorganic Chemistry Practical-II	4	--	--	--	--	--	--
	20PCY418	Organic Chemistry Practical-II	4	--	--	--	--	--	--
	20PCY419	Physical Chemistry Practical -II	4	--	--	--	--	--	--
Total									**18+3**
IV	20PCY414	Inorganic Chemistry –III- Bioinorganic and Inner Transition Elements	5	65	3	30	70	100	4
	20PCY415	Analytical Techniques	5	65	3	30	70	100	4
	20PCY4E5 20PCY4E6	*Major Elective –III-Medicinal Chemistry (or) Green and Nano Chemistry	3	39	3	30	70	100	3
	20PCY416	Phytochemical techniques and health chemistry	Self - study	--	3	--	100	100	Grade
	20PCY4CE	Online-Comprehensive examination	--	--	1	--	--	--	Grade
	20PCY417	Inorganic Chemistry Practical-II	5	117	6	40	60	100	3
	20PCY418	Organic Chemistry Practical-II	5	117	6	40	60	100	3
	20PCY419	Physical Chemistry Practical -II	5	117	6	40	60	100	4
	20PCY420	Project Work & viva voce	2	26	6	20	80	100	7
	20PCV401/ 20PCV402	Value Added Course Cosmetic Chemistry/ Treatment of industrial waste water	5	30	3	--	100	100	Grade
* Students can choose any one of the papers as electives									**28**
Total								**2200+ 300**	**90 +3**

LIST OF ELECTIVES

SEMESTER	SUBJECT CODE & TITLE
II	**MAJOR ELECTIVE-I** 20PCY 2E1- Applied Electro Chemistry 20PCY 2E2 -Food Science and Technology
III	**MAJOR ELECTIVE-II** 20PCY3E3- Research Methodology & Cyber Security 20PCY3E4-Industrial Chemistry
IV	**MAJOR ELECTIVE-III** 20PCY4E5- Medicinal Chemistry 20PCY4E6–Green and Nanochemistry

Bloom's Taxonomy Based Assessment Pattern

K1- Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze; **K5**- Evaluate

1. Theory: 70 Marks

(i) TEST- I & II and ESE:

Knowledge Level	Section	Marks	Description	Total
K1 & K2	A(Answer all)	5x1=5 5x1=5	MCQ One line Answers	75
K3	B (Either or pattern)	5x5=25	Short Answers	
K4& K5	C(Answer 4 out of 6) 16th Question Compulsory	4x10=40	Descriptive/ Detailed	

2. Theory: 100 Marks (NME)

Knowledge Level	Section	Marks	Description	Total
K3	A(Answer 5 out of 8)	5x5=25	Short Answers	100
K4 & K5	B (Answer 5 out of 8)	5 x 15=75	Descriptive/ Detailed	

3. Practical Examinations:

Knowledge Level	Section	Marks	Total
K3	Experiment & Record work	60 (External)	100
K4		40 (Internal)	
K5			

4. Project:

Knowledge Level	Section	Marks	Total
K4	1. Literature Review & Presentation (IV – Semester) (Internal)	20	100
K5	Project report present & viva (External)	80	

Components of Continuous Assessment

Components		Calculation	CIA Total
Test 1	70	$\frac{70+70+25+25+25+25}{8}$	30
Test 2	70		
Assignment	25		
Seminar/ Tutorial	25		
Knowledge Enhancement	25		
Information acquisition	25		

PROGRAMME OBJECTIVES

Programme Outcomes

PO1. Students should have an advanced level understanding of at least three of the following areas of chemistry - Analytical, Inorganic, Organic and Physical Chemistry.

PO2. Students should have a professional Skill to handle standard equipment's and to analyze the data.

PO3. Students should acquire the basic tools needed to carry out independent chemical research.

PO4. Ability to present chemical research results to a technically literate audience by means of an oral presentation, scientific poster or a written report.

PO5. Ability to assimilate in the course of different modules throughout the various years of study and to apply this when required.

Programme Specific Outcomes

PSO1 Gain knowledge and understanding in the field of chemical science.

PSO2 Develop eco-friendly chemical processes and impact of chemistry on health and environment.

PSO3 Impart the basic analytical and technical skills to work effectively in the various fields of chemistry.

PSO4 Acquires research oriented higher learning that develops analytical, innovative ideas and integrative problem-solving approaches.

PSO5 Stimulate the students to sustainable environmental practices and get trained for industrial entrepreneurship.

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY101**	**Inorganic Chemistry –I- Solid state and Nuclear Chemistry**	**Batch :**	2020-2022
			Semester	I
Hrs/Week:	5	**Total Hrs: 65 Hrs**	**Credits:**	4

Course Objective

- To learn about inorganic crystals and structural determination methods of solids.
- To understand the concepts acids and bases.
- To gain knowledge about structure and bonding in inorganic chains and rings.
- To understand the principles of nuclear model, modes of decay and detection, measurement of radio activity, nuclear reactors and applications.

Course Outcomes (CO)

K1	CO1	Distinguish the types of solids and their defects.
K2	CO2	Remember the introduction of acid-base concepts and nuclear chemistry.
K3	CO3	Identify and extend the applications of inorganic compounds as rings and clusters, non-aqueous solvents in reactions.
K4	CO4	Applythe electrical properties of solid state, radioactive and counter techniques.
K5	CO5	Evaluate n/p ratio, binding energy and Q-value of nuclear reactions.

Unit-1

Solid state **13Hrs**

Introduction of solid state-Close packing of spheres - packing efficiency - hexagonal close packed (hcp) and cubic close packed (ccp) structures - coordination number - tetrahedral and octahedral holes - limiting radius ratio rule- point defects in solids - Schottky and Frenkel defects – dislocations-Study of structures of rutile, fluorite, antifluorite, zinc blende, wurtzite, perovskite, ilmenite and spinels.

Metallic state - *free electron theory* and band theory - Electrical properties of solids - insulators - intrinsic semiconductors - super conductivity - Meissner effect - BCS (cooper pair) theory.

Self study: Impurity Semiconductors (n type and p type)

Unit-2

Modern concepts of Acids and bases **13Hrs**

Lewis concept - levelling solvents - solvent system concept- Lux-flood concept - Cady-Elsey concept - Usanovich concept - HSAB principle - Pearson concept – Theories of Hardness and Softness – Acid and base strength of HSAB, limitations and applictaions of HSAB.

Non aqueous solvents – Levelling effect of the solvent - classification of solvents – chemical reactions in liquid ammonia, liquid HF, liquid N_2O_4, liquid SO_2 and oxyhalide solvents.

Self study: Characteristic Properties of Ionizing Solvents

Unit-3

Rings, Cages and Clusters **13Hrs**

Chains – catenation, heterocatenation, isopolyanions, heteropolyanions (explanation with examples).

Cages –Structure and bonding of phosphorous compounds, boranes, carboranes and metallocene carboranes.

Metal clusters - Structure and bonding of dinuclear, trinuclear, tetra nuclear and hexa nuclear clusters - polyatomic zintl anions and cations - chevral phases.

Rings - borazines - phosphonitrilic compounds- sulphur - nitrogen ring compounds (S_4N_4).

Self study: Fullerenes and their Applications

Unit-4

Nuclear Chemistry -I **13Hrs**

Stability of nuclei - packing fraction - even - odd nature of nucleons - n/p ratio - nuclear potential - binding energy and exchange forces - shell model and liquid drop model.

Decay of radio nuclei: rate of decay - determination of half-life period - secular equilibrium and decay series. Modes of decay: alpha, beta, gamma and orbital electron capture- nuclear isomerism - internal conversions.

Nuclear Reactions

Q – value, columbic barrier – nuclear cross section – different types of nuclear reactions projectile capture – particle emission, spallation, fission and fusion – Product distributions – theories of fission, use of fission products, fissile and fertile isotopes- U-238, U-235, Pu-239, Th-232.

Self study: Stellar Energy

Unit-5

Nuclear Chemistry -II **13Hrs**

Radioactive and Counting techniques - tracer technique, neutron activation analysis, Particle acceleration: linear accelerator - cyclotron and synchrotron - betatron - G.M counter - proportional and scintillation counters.

Radio Isotopes: Applications – isotopes as tracers – uses in structure and mechanistic studies – carbon dating, industry, medicine and agriculture- Hot-atom chemistry-Safety measures.

Self study: Disposal of Nuclear Waste

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=O377ShVgLi0&list=PLFW6lRTa1g82yuaxHUfC72ZPBViN95T-D&index=1

https://www.youtube.com/watch?v=Xs7SFulW4oE&list=PLXLBkCN7a8rn9Em3D5CRAOANhjwvC4CUK&index=1

Text Books:

1. Puri, B.R., Sharma,L.R and Madan S. Pathania (2006). *Principles of Inorganic Chemistry*. 41st edition. Vishal Publishing Co.
2. Gurdeep Raj, N. (2014). *Advanced Inorganic Chemistry*. 12th Edition. Geol Publishing House
3. Madan, R.D. (2011). *Advanced Inorganic Chemistry*. 3rd Edition. S. Chand & company, New Delhi.
4. Arnikar, H.J. (2000). *Essentials of Nuclear Chemistry*. 4th Edition. New Age International.
5. James E. Huheey. (1997). *Inorganic chemistry Principles of structure and reactivity*, 4th Edition. Pearson India Limited.

Reference Books:

1. Keith F. Purcell and John, C. Kotz. (1980). *Inorganic chemistry*, Holt- Saunders International Editions
2. Cotton, F. A. and Wilkinson,G. (2014). *Advanced Inorganic Chemistry*. 6th edition. Wiley & Sons.
3. Bodie E. Douglas, Darl H. McDaniel and John J. Alexander.(1970), *Concepts and Models of Inorganic Chemistry*, 3rd edition. Wiley & Sons.
4. Gary L. Miessler and Tarr,D. A (2004), *Inorganic Chemistry*,3rd edition, Pearson Publication.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	H	S	H	S
CO2	S	H	S	H	S
CO3	S	H	S	H	S
CO4	S	H	S	H	S
CO5	S	H	S	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms.R.Mini Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY102**	**Organic Chemistry –I- Reactions and Mechanisms**	**Batch :**	2020-2022
			Semester	I
Hrs/Week:	5	**Total Hrs: 65 Hrs**	**Credits:**	5

Course Objective

- To understand aromaticity and reaction mechanism.
- To provide knowledge about electrophilic, Elimination reactions and nucleophilic substitution reactions.
- To learn about the basic ideas about organic reaction intermediates.

Course Outcomes (CO)

K1	CO1	Remember the aromaticity of compounds and Develop skills for identifying the kinetics of reactions.
K2	CO2	Understand the mechanism of different types of substitution, addition and elimination reactions for synthesizing organic compounds.
K3	CO3	Apply the mechanisms in solving chemical reactions.
K4	CO4	Inspect the different types of reactions involved in chemical synthesis.
K5	CO5	Evaluate the various types of reaction intermediate.

Unit-1

Aromaticity **13Hrs**

Aromatic character – Huckel's Molecular orbital theory for aromaticity (HMO), concept of aromaticity and anti aromaticity – Critereia for aromaticity, Non-benzenoid aromatic compounds-Monocyclic and bicyclic non-benzenoid neutral compounds (Annulenes and azulenes).Antiaromatic and Homoaromatic compounds- Alternant and non-alternant hydrocarbons**.**

Kinetic and Non-kinetic Methods of Determination of Reaction Mechanisms

Reaction Mechanism: Kinetic methods- Mechanistic implications of rate law- Isotope effects. Kinetic and thermodynamic control of reactions - Hammonds postulates, linear free energy relationship- Hammett and Taft equations.Types of reactions and mechanisms, Non kinetic methods-Product analysis, intermediate criteria (isolation, trapping and detection) - Isotopic labeling and cross over experiments- Stereochemical evidence.

Self study: Tautomerism −keto −enol, amido −imido and nitro −acinitro systems, Primary and secondary kinetic isotopic effects.

Unit-2 - Electrophilic substitution reactions **13Hrs**

Aliphatic electrophilic substitution reactions – Mechanism

SE1, SE2 and SEi mechanism. Factors affecting reactivity in SE reactions - Typical reactions – hydrogen exchange and migration of double bond, halogenation of carbonyl compounds.

Aromatic electrophilic substitution reactions

Arenium ion mechanism - orientation and reactivity in mono substituted benzene rings – steric effects and ortho/para ratios - ipso attack, orientation in di-substituted benzene rings. Typical reactions - Friedel Crafts alkylation & acylation, Vilsmeier-Haack reaction, Gattermann-Koch reaction, Hofmann-Martius, Jacobsons reaction, Houben-Hoesch reaction, Diazonium coupling.

Self study: Stork enamine reactions, cyclic mechanism,Bradsher reaction and Bischler-Napieralski reaction

Unit-3 - Nucleophilic substitution reactions **13Hrs**

Aliphatic nucleophilic substitution

S_N1, S_N2 and S_Ni reactions and mechanisms - factors affecting nucleophilic substitution reaction - ambident nucleophiles and ambident substrates. Substitution at vinyl carbon and allylic carbon - hydrolysis of esters ($A_{Ac}1$, $A_{Ac}2$ and $B_{Ac}2$ only). Typical reactions - Wurtz reaction - Claisen and Dieckmann condensation - Williamson reactions.

Aromatic nucleophilic substitution: S_NAr - benzyne mechanism - Zeigler alkylation - Chichibabin reaction - Vonbraun reaction - Cine substitution.

Self study:Neighbouring groupparticipation by σ and π bonds, anchimeric assistance, Rosendmund Reactions, Von Richter rearrangement

Unit-4

Addition and elimination reactions **13Hrs**

Addition to C-C and C-O multiple bonds - electrophilic, nucleophilic and free-radical additions - additions to conjucated systems - orientation - Birch reduction - hydroboration - Michael condensation - 1,3 dipolar additions - Diels-Alder reactions - carbene addition to double bonds - hydration of olefines.

Elimination reactions-E1, E2, E1cB - stereochemistry of elimination, Hofmann and Saytzeff's rules - elimination versus substitution - pyrolytic cis elimination.

Self Study: Mannich reaction - Meerwein-Pondorf reduction - Darsen - Wittig - Thorpe and benzoin condensations, Chugaev reaction – dehydration of alcohols, dehydro halogenation of vicinal dihalides, Hofmann degradation, Cope elimination

Unit-5

Reactive Intermediates **13Hrs**

Classical and non-classical carbocations, carbanions, radical- anions, radical-cations, carbenes, arynes and nitrenes. General methods of generation**,** detection and reactivity of theseintermediates.

Types of free radical reactions, Mechanism of free radical reaction, mechanism at an aromatic substrate, Reactivity in aliphatic substrate, alkenes, alkyl side chain aromaticcompound and at bridgehead. Effect of solvent on reactivity.

Self study: Sandmeyar, Gomberg, Ullman, Pschorr and Hunsdiecker reactions.

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=T1ePwEQ4Fa0

https://www.youtube.com/watch?v=QkQUJhJYPA0

https://www.youtube.com/watch?v=hsBn-BxuN0M

https://www.youtube.com/watch?v=RtV_JxzZoss

https://www.youtube.com/watch?v=-D8tYR3LTsI

Text Books:

1. Mukherjee, S.M andSingh, S.P. (2004), *Reaction Mechanism in Organic Chemistry*. 10th Edition, Macmillan India Ltd.
2. Agarwal, O.P. (2014),*Reactions and Reagents in Organic Chemistry*. 49th Edition. Goel publishing house.
3. Ahluwalia, V.K. Rakesh K. Parashar (2010). *Organic Reaction Mechanisms*. 4th Edition. Narosa Publsihing House.
4. Tewari, Vishnoi, K.S, (2006). *Text book of Organic Chemistry.* 3rd Edition. Vikas Publication.
5. JagadambaSingh and Yadav, L.D.S, (2014),*Advanced Organic Chemistry.* 20thEdition. Pragati prakasham publishers.

Reference Books:

1. Finar, I.L. (2002) *Organic Chemistry. Vol.1*. 5th Edition. Pearson India Ltd.
2. Jerry March (2007) *Advanced organic chemistry*. 4th Edition, A Wiley-Interscience.
3. Morrison, R.T, Boyd, R.N (2013) *Organic Chemistry*.7th Edition. Pearson India Ltd.
4. Skyes, P, (2001), Guide Book to Mechanism in Organic Chemistry, Pearson Education.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	S	H	S
CO2	S	S	S	H	S
CO3	S	S	S	H	S
CO4	S	S	S	H	S
CO5	S	S	S	H	S

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY103**	**Physical Chemistry –I – Group Theory and Chemical Kinetics**	**Batch :**	2020-2022
			Semester	I
Hrs/Week:	5	**Total Hrs: 65 Hrs**	**Credits:**	5

Course Objective

- To give a thorough introduction to the study of group theory.
- To learn about rate and order of the various reactions.
- To learn the concept of photochemistry and its applications.

Course Outcomes (CO)

K1	CO1	Classify molecules based on their different point groups and recollect rate of chemical reactions.
K2	CO2	Apply the point groups of various molecules andconstruct the character table for point groups and understand the different theories of chemical kinetics.
K3	CO3	Predict the IR and Raman active vibration modes for molecules and type of hybridization in nonlinear molecules based on group theory.
K4	CO4	Detect the principles of Photochemistry and its important applications.
K5	CO5	Examine hybridization scheme for orbital in simple molecules.

Unit-1

Group theory-I: **13Hrs**

Symmetry elements and symmetry operations - identity element - centre of symmetry- reflections symmetry planes - proper and improper rotation axes of symmetry. Group definition, properties-order of group- types of groups-sub group, isomorphic group - similarity transformation and classes.

Point group classification- identification of point groups of simple molecules -group multiplication table (c_{2v} and c_{3v} point group) – Matrix representation of symmetry operations – Reducible and Irreducible representations - orthogonality theorem and properties of irreducible representations.

Self study: Abelian group, Non - abelian group

Unit-2

Group theory-II **13Hrs**

Character tables –construction of the character table for C_{2v} and C_{3v} point groups - direct product representation - wave function as bases for irreducible representation - spectral transition probabilities - Symmetry Adapted Linear Combinations (SALC) - projection operators and their use to

construct SALC - Huckel approximation -concept of hybridization - secular determinant - symmetry factoring of secular equations.

Symmetry selection rule for IR, Raman spectra and rotational spectroscopy - infrared spectral activity of vibrational modes in NH_3 and H_2O molecules - classification of vibrational modes - application of group theory to bonding: hybridization scheme for orbital in simple molecules - AB_4 (T_d, CH_4), AB_5 (D_{3h} $Fe(CO)_5$) and AB_6 (O_h $[Co(NH_3)_6]^{3+}$).

Self study: Mutual Exclusion Principle

Unit-3

Chemical Kinetics-I **13Hrs**

Simultaneous reactions - opposing, parallel and consecutive reactions - theories of reaction rates - Arrhenius theory - collision theory - classical collision theory- modified collision theory - causes of weaknesses of the collision theory - absolute reaction rate or transition state theory - Statistical mechanical derivation of the rate equation - thermodynamical formulation of reaction rate, Lindeman's theory of unimolecular reactions.

Kinetics in liquid solution - Salt effect - primary salt effect and secondary salt effect - significance of salt effect - effect of pressure on rates of reactions in solutions.

Self study: The Steady State Approximation

Unit-4

Chemical Kinetics-II **13Hrs**

Experimental methods of fast reactions - shock tubes and pulse radiolysis techniques - kinetics of decomposition of N_2O_5, H_2-Cl_2.

Photochemical reactions and H_2-Br_2 thermal reaction - non-stationary chain reaction - H_2-O_2 reaction and explosion limits. Effect of temperature, relative permittivity, ionic strength and solvent (Grunwald-Winstein equation) on reaction rates.

Self study: Chain Reactions - general characteristics

Unit-5

Fundamentals of Photochemistry **13 Hrs**

Physical properties of the electronically excited molecules- excited state dipole moment- geometry of some electronically excited molecules - types of photophysical pathways.

Fluorescence emission – Phosphorescence – luminescence - Photophysical kinetics of unimolecular processes - Stern-Volmer equation – quenching - delayed fluorescence - study of excited states - flash photolysis, laser, maser and its applications.

Self Study: excited state acidity constants - pK* values

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Experience Discussion, Brain storming activity and Case study

Web links:

https://www.youtube.com/watch?v=SmZ7CSvETNo
https://www.youtube.com/watch?v=Av9f25sqLG0
https://www.youtube.com/watch?v=5m8ubFNFJUU
https://www.youtube.com/watch?v=-we7yTR7exI

Text Books:

1. Raman, K.V. (1996), *Group Theory and its applications to chemistry*, Tata McGraw Hill publishing company Ltd.
2. Bhattacharya, P.K. (1986),*Group theory and its chemical applications*, Himalaya Publishing House
3. Gopinathan, M. S. and Ramakrishnan, V. (1988), *Group Theory in Chemistry*, Vishal Publishers.
4. Gurudeep Raj, (2014),*Chemical Kinetics*, Krishna Educational Publishers.
5. Bajpai, D.N. (1992),*Advanced Physical Chemistry*, S. Chand Publishing Limited.

Reference Books:

1. Cotton, F.A. (1990),*Chemical applications of group theory*, 3rd Edition, A Wiley Interscience Publication.
2. Laidler. K. J (1987),*Chemical Kinetics* 3rd Edition. Pearson Education India.
3. Rohatgi-Mukherjee. K.K, (2014), *Fundamentals of Photochemistry*, 3rd Edition, New Age International Publishers.

Mapping

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CO3	S	S	S	H	H
CO4	S	S	S	H	H
CO5	S	S	S	H	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. K.Vimaladevi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY204**	**Inorganic Chemistry - II Coordination and Organometallic Chemistry**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	5	**Total Hrs: 65 Hrs**	**Credits:**	5

Course Objective

- To know about theories of bonding in inorganic complexes and application, substitution reaction mechanism of coordination complexes, electron transfer mechanism of coordination complexes.
- To apply the knowledge of coordination chemistry to research.
- Acquire knowledge regarding organometallic complexes.

Course Outcomes (CO)

K2	CO1	Explain the bonding characteristics in coordination compounds in terms of Crystal Field Theory and Molecular Orbital Theory.
K4	CO2	Examine the spectra of complexes using TS and Orgel diagrams.
K5	CO3	Formulate mechanisms for reactions of transition metal complexes.
K3	CO4	Appraise the preparation, properties and uses of metal carbonyls.
K4	CO5	Apply coordination complexes as catalyst for reactions.

Unit-1

Coordination Chemistry –I **13 Hrs**

Theories of coordination compounds - valence bond theory- crystal field theory - splitting of d orbitals in different symmetries - crystal field stabilization energy - factors affecting the magnitude of 10 Dq - evidence for crystal field stabilization - Spectrochemical series - applications of CFSE- tetragonal distortion from octahedral symmetry - Jahn-Teller distortion. Molecular orbital theory - octahedral complexes - pi bonding theory - experimental evidence for pi bonding.

Stability of complex ions-factors affecting the stability of complex ions- Irving-William series- relation between stepwise formation constant and overall formation constant, determination of stability constant by electrochemical method.

Self study: Magnetic Properties - I row transition metal complexes : comparison of magnetic properties of Oh, Td & square planar Fe(II), CO(II), Ni(II) & Cu(II) complexes.

Unit-2

Coordination Chemistry –II **13 Hrs**

Quantum number of multi electron atoms- R-S coupling and micro states- ground state terms of d^1 to d^{10}- Hund's rule in determination of low energy states - derivation of terms for $p^2$and d^2 ions.

Electronic spectra of coordination compounds - selection rules - band intensities and band widths - Nephelauxetic effect, Orgel diagrams - Tanabe-Sugano diagrams (for d^2 and d^5 systems only) - calculation of 10Dq and B for V^{3+}(oct) and Ni^{2+}(oct) complexes.

Self study: Charge transfer spectra- effect of Jahn-Teller distortion and spin orbit coupling on Spectra

Unit-3

Coordination Chemistry –III **13 Hrs**

Labile and inert complexes - Substitution reactions in square planar complexes - the rate law for nucleophilic substitution in a square planar complex - the trans effect - theories of trans effect - uses of trans effect. Ligand substitution reactions in octahedral complexes - types and mechanism of substitution reactions S_N1 and S_N2 type - acid hydrolysis reaction- catalysed aquation type, base hydrolysis reaction - S_N2 and S_N1CB mechanism - anation reactions.

Mechanisms of redox reactions - outer sphere mechanisms - excited state outer sphere electron transfer reactions - inner sphere mechanisms.

Self study: Complementary and Non-complementary reactions

Unit-4

Organometallic Chemistry – I **13 Hrs**

Definition of organometallic compound - 18 electron rule - EAN rule - concept of hapticity - classification of organometallic compound - the metal carbon bond types - ionic bond - sigma covalent bond - electron deficient bond - dative bond. Metal carbonyls - IR spectroscopy of metalcarbonyls. Carbonylate ions, Carbonyl hydrides, Carbonyl halides, Metal nitrosyls

Self study: Wades rule, Sytx number and Isolobal relationship

Unit-5

Organometallic Chemistry – II **13 Hrs**

Synthesis, reactions, bonding and structure in metal alkene, alkyne, allyl,dienyls and Cyclobutadiene complexes.

Preparation, properties, structure and bonding in cyclopentadienyl *complexes (Ferrocene)*, arene complexes (Di benzene chromium), cyclo hepta trienyl complexes.

Self study: Basic concept of fluxional molecules

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=rlz3_1ofdQs&list=PL8TbBPqune7T-MwkLf-2FTAtE1WjjgCQr
https://www.youtube.com/watch?v=mlI1hnJZleo&list=PL8TbBPqune7T-MwkLf-2FTAtE1WjjgCQr&index=2
https://www.youtube.com/watch?v=HvwswG8FmqE
https://www.youtube.com/watch?v=M38GJOTjwr0

https://www.youtube.com/watch?v=SqxcALnh4zg
https://www.youtube.com/watch?v=86rNPVAtj0Y
https://www.youtube.com/watch?v=vPdEtYNAyp0
https://www.youtube.com/watch?v=yjNpuBHlSVc
https://www.youtube.com/watch?v=CPTu1YswO1w

Text Books:

1. Atkins, P.W., Overton, T.L., Rourke, J.P., Weller,M.T., Armstrong, F.A., (2010) *Inorganic Chemistry*, 5th Edition, Oxford University Press
2. Malik, U.K., Tuli, G.D., and Madan, R.D., (2010). *Selected Topics in Inorganic Chemistry*, S. Chand Publication.
3. Gopalan, R., Ramalingam, V., (2001). *Concise Coordination Chemistry*, 3rd edition, Vikas Publishing house pvt Ltd
4. Cotton, F.A., and Wilkinson,G., (1998). *Advanced Inorganic Chemistry*, 4th& 5th Edns, Wiley Interscience, New York,

Reference Books:

1. Keith F. Purcell, John. C. Kotz. (1980),*Inorganic chemistry*, Holt- Saunders International Editions.
2. James E. Huheey. (1997),*Inorganic chemistry Principles of structure and reactivity*, 4th Edition. Pearson India Limited.
3. Basolo, F. & Pearson. R.G. (1967),*Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution.* Wiley Eastern Limited.

Mapping

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S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name:Dr.K.Poonkodi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY205**	**Organic Chemistry –II – Organic reactions and Stereochemistry**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	4	**Total Hrs: 52 Hrs**	**Credits:**	5

Course Objective

- To give a thorough introduction to the study of Oxidation, Reduction and alkaloids.
- To know the concept of Organic Photochemistry.
- To enable a comprehensive knowledge on conformational stereochemistry and pericyclic reactions.

Course Outcomes (CO)

K1	CO1	Understand the basic of oxidation and reduction reactions, and photochemistry.
K2	CO2	Outline the importance of pericyclic reactions, to figure out isomerism and conformational analysis of stereochemistry and to understand the structural elucidation of alkaloids.
K3	CO3	Implement the basic values and analyze the functions of the natural product such as alkaloids.
K4	CO4	Analyse the reagents in chemical reactions, to execute photochemical and pericyclic reactions.
K5	CO5	Evaluate the stereochemical isomerisation, configuration and conformations of molecules.

Unit-1

Oxidation **11 Hrs**

DMSO with either Ac_2O or oxalyl chloride, Dess-Martin reagent.Synthesis involving phase transfer catalysis (PTC), use of crown ethers, baker's yeast, Oppanauer oxidation, Jones oxidation.

Reduction

Catalytic hydrogenation - Wilkinson catalyst, dehydrogenation, reduction with $LiAlH_4$, $NaBH_4$, tertiary butoxy aluminum hydride, $NaCNBH_3$, tributyl tin hydride, alkali metals for reduction, reductions involving hydrazines.

Self study: Chromyl chloride, ozone, DDQ, dioxiranes, selenium dioxide Clemmensen and Wolff kishner reduction, Birch reduction, MPV reduction.

Unit-2

Organic photochemistry **10 Hrs**

Jablonski diagram - chemical actinometry - photosensitization - quenching. Photochemistry of carbonyl compounds - photoreduction - Norrish type I and type II reactions, Photoadditions - Barton reaction-Patterno-Buchi reaction.

Photochemistry of olefins - cis and trans isomerization - dimerization reactions - cycloaddition reactions - 1,2 cycloadditions - photooxidation .

Self study: Laws of photochemistry - Beer-Lambert, Grothus-Draper law, Stark-Einstein law – electronic excitation - energy transfer - quantum efficiency, Photo substitution reactions of benzene derivatives

Unit-3

Pericyclic reactions **11 Hrs**

Conservation of molecular orbital symmetry - symmetry properties of molecular orbitals. Electrocyclic reactions - 1,3-diene and 1,3,5-triene systems, correlation diagram and FMO method, Woodward-Hoffman selection rule for electroyclic reactions -con rotatory and dis rotatory motions 4nπ and (4n+ 2)π systems.

Cycloadditions reactions - correlation diagram and FMO approach, π2s + π2s, π2s + π4s (Diels-Alder reaction) systems. Woodward-Hoffman selection rule for cycloaddition reactions,

Sigmatropic rearrangements - analysis of sigmatropic rearrangements by FMO method - 1,3& 1,5 sigmatropic rearrangements.

Self study:Simple problems in pericyclic reaction, other sigmatropic shifts - Cope and Claisen rearrangements, ene reaction

Unit-4

Stereochemistry **11 Hrs**

Optical isomerism of biphenyls, allenes and spiranes -optical isomerism of ansa compounds and cyclophanes - Optical isomerism of over – crowded molecules - R, S – nomenclature of compounds having one and more than one chiral centres - enantiotopic and diastereotopic ligands & faces - stereo selective and stereo specific reactions – stereochemistry of sulfur and nitrogen compounds.

Geometrical Isomerism

Stereoismerism of cyclic compounds (up to six membered ring)– aldoximes & ketoximes.

Conformational Analysis - configuration and conformation – Conformation of acyclic compounds – ethane, butane, cyclohexane, decalins – stability and reactivity in relation to conformation – perhydrophenanthrenes.

Self study: Optical isomerism – concept of chirality - concept of prochirality - axial chirality and planar chirality, helicity, E, Z – notation – Determination of configuration of geometrical isomers

Unit-5

Alkaloids **09 Hrs**

Structural elucidation and synthesis of morphine, reserpine, quinine, atropine and papaverine.

Self study: Introduction-isolation of alkaloids

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=uwia3_Her8s
https://www.youtube.com/watch?v=qB9V2uMaxA8
https://www.youtube.com/watch?v=Pp0LeL0SkRg
https://www.youtube.com/watch?v=J_b1Y4QhhZc
https://www.youtube.com/watch?v=JROZc-9DayM
https://www.youtube.com/watch?v=BBljnB-6420
https://www.youtube.com/watch?v=wNyijTBpOrI

TextBooks:

1. Mukerjee S.M. & Singh, S.P. (2013),*Reaction mechanism in organic chemistry*, 3rd Edition, McMillan India Ltd
2. Ahluwalia, V.K. Rakesh K. Parashar (2010). *Organic Reaction Mechanisms*. 4th Edition. Narosa Publsihing House.
3. Kalsi. P.S. (1995). *Stereochemistry, Conformation and Mechanism*. 3rd edition. John Wiley sons.
4. Nasipuri. D (1994). *Stereochemistry of Organic Compounds.* New age International.
5. Agarwal O. P. (2001),*Natural product Chemistry*. 20th Edition Goel Publishing house.
6. Jagadambal and Singh (2014),*Advanced Organic Chemistry.* 20thEdition. Pragati prakasham publishers.

Reference books:

1. Depuy,C.H. & Chapman. O.S. (1972),*Molecular reactions and photochemistry*.Prentice Hall.
2. Eliel. E.L, Wilen. S.H. (1994),*Stereochemistry of Organic Compounds.* Wiley International
3. Potapov, V.M. Beknazarov. A. (1980),*Stereochemistry*. Mir Publications. Russia.
4. Jerry March (2007), *Advanced organic chemistry*. 4th Edition, AWiley-Interscience.

Mapping

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S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY206**	**Physical Chemistry –II – Quantum and Electrochemistry**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	5	**Total Hrs: 65 Hrs**	**Credits:**	5

Course Objective

- To motivate the students to comprehend a knowledge on quantum mechanics.
- To apply the quantum mechanical concept to simple molecules.
- To learn the concepts of kinetics of polymerization

Course Outcomes (CO)

K1	CO1	Remember the dual character of electrons. To understand the concepts of classical and quantum mechanics, to picture out the failure of classical mechanics.
K2	CO2	Understand the Schrödinger wave equation to particles in a system.
K3	CO3	Comprehend the approximate methods in quantum mechanics and apply it to simple molecules.
K4	CO4	Analyze the final solution, energy and wave function for H atom and to review the mechanisms.
K5	CO5	Estimate the molecular weight and stereochemistry of macromolecules.

Unit-1

Quantum Chemistry-I **13 Hrs**

Success of quantum theory and the failure of classical mechanics - basic concepts - time dependent and time independent Schrodinger equation - requirement of an acceptable wave function - operator concept as applied to quantum mechanics (basic ideas) – Derivation of energy and angular momentum operator-ladder operators -eigen functions and eigen values - postulates of quantum mechanics - application of Schrodinger equation to the particle in a box (1-D& 3-D Boxes) - particle in a ring & particle in spherical orientation.

Self Study: black body radiation

Unit-2

Quantum Chemistry-II **13 Hrs**

Harmonic oscillator and rigidrotator - central force problem - H-atom - method of separation of variables - final solution - the energy and wave function for the problem

Approximation Methods: Approximate methods in quantum mechanics - need for the approximation methods - perturbation and variation methods applicable to Hatom in ground state - He atom in the ground state and excited state, He^+ in the ground state - electron spin and Pauli's principle.

Self Study: Quantum numbers - shapes of the wave functions

Unit-3

Quantum Chemistry-III **13 Hrs**

Slater determinants - HMO treatment of simple and conjugated π- electron systems - ethylene, allyl, butadiene and benzene systems - delocalization energy- construction and use of hybrid orbitals - determination of bond order.

Self Study: Introduction to LCAO - MO methods

Unit-4

Electrochemistry **13 Hrs**

Debye- Huckel- Onsager equation- Falkenhagen effect, Wein effect - ionic strength, Debye-Huckel limiting law and its verifications - electrode potential - concentration cells - liquid junction potential.

Electrokinetic phenomena: Theories of double layer - Helmoltz-Perrin, Gouy-Chapmann & Stern theories –Theories of over voltage and zeta potential- elecrodics - mechanism of electrode reactions - polarization and over potential - Butler-Volmer equation - electrophoresis and electro osmosis.

Self Study: *Conductance* - transport number

Unit-5

Kinetics of polymerizations **13Hrs**

Determination of molecular weights - number average, weight average, sedimentation and viscosity average molecular weights of macromolecules. Kinetics of polymerization - free radical mechanism. Techniques of Polymerisation: bulk, emulsion, solution and suspension, Stereochemistry of polymers, Polymer processing - types of moulding - casting, spinning and vulcanization.

Self study: Addition and Condensation polymerization

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=LnmCsNQsR68
https://www.youtube.com/watch?v=uPvWlwOhCTo
https://www.youtube.com/watch?v=p82enyv3XA0
https://www.youtube.com/watch?v=_MCbWJa4u-4
https://www.youtube.com/watch?v=AYRuPNK6WNM
https://www.youtube.com/watch?v=gLesbQ8MPlU
https://www.youtube.com/watch?v=ASPuNKrCzDE

Text books:

1. Ira N. Levine. (2014) *Quantum Chemistry*, 7th Edition., PHI learning Pvt. Ltd.,
2. Puri, B.R & Sharma. L. R. (2009),*Advanced Physical Chemistry*, 2nd Edition., Milestone Publishers & Distributors
3. Chandra, A.K (1994) *Introductory Quantum Chemistry*, 3rd Edition, Tata McGraw Hill Publishing Company.
4. Prasad, R. K, (1995), *Quantum Chemistry*, TMH.
6. Billmeyer. F.W (1994), *Text book of polymer science*, 3rd Edition, Thomson press (India) Ltd.
7. Gowariker. V.R, (1986),*Polymer science*, Wiley Eastern Ltd.
8. Atkins. P.W,*Physical Chemistry*, 6th Edn. Oxford University Press, 1998

Reference books:

1. Hanna. M. (1969),*Quantum Mechanics in Chemistry*. 2nd Edition. Addison Wesley Longman.
2. Mcquarrie, D.A. (2008),*Quantum Chemistry*. 2nd Edition University Science Book.
3. John O' M. Bockris, Amulya K.N. Reddy, Maria Gamboa-Aldeco, Maria E. Gamboa- Aldeco (1986),*Modern Electrochemistry*, Volume 2, Part 1, 2nd Edition Springer International.
4. Glasstone, (1943), *An Introduction to Electrochemistry*, Van Nostrand Co. Inc., Newyork.

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Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. M. Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY2E1**	***Major Elective -I Applied Electrochemistry**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	3	**Total Hrs: 39 Hrs**	**Credits:**	3

Course Objective

- To learn about Current - Voltage relationship, Electrochemical cells, Electroplating.
- To gain knowledge about batteries and its commercial applications
- To understand about corrosion and its control.

Course Outcomes (CO)

K1	CO1	Recollect the fundamentals of electrochemistry.
K2	CO2	Understand the principles and applications of various current-voltage instruments.
K3	CO3	Appraise the process of Electroplating.
K4	CO4	Analyze current and voltage using various techniques.
K5	CO5	Discuss the types of batteries, fuel cells, theories of corrosion & its mechanism.

Unit-1

Potential Sweep methods **8 Hrs**

Current-voltage relationships -Voltametry – Polarography - mass transfer - diffusion limited currents - kinetic currents - adsorption currents - amperometry, coulometry, cyclic voltametry, rotating disc electrodes, chronoamperometry, chronopotentiometry, chronocoulometry (basic principles and applications only in all the above methods).

Self study: Conductometric and potentiometric titrations

Unit-2

Cells **8 Hrs**

Electrochemical cells - Types of cells - divided and undivided cells - chlor-alkali cells mercury, diaphragm and membrane cells - electro-inorganic chemicals - chlorates, perchlorates - electrosynthesis of fluorine - electro-organic chemicals - electro-reduction of nitro and carbonyl groups - Kolbe synthesis-electro dimerisation - adiponitrile.

Self study: Components of electrochemical cells

Unit-3

Batteries **8 Hrs**

Thermodynamics of batteries and fuel cells - half cell reactions in batteries - characteristic requirements of a battery system - porous electrodes - separators -evolution of batteries - charge - discharge characteristics - primary batteries, lead acid batteries - Leclanche cells - lithium cells - Ni-Cd cells - High temperature batteries - sodium-sulphur system – H_2-O_2 fuel cell.

Self study: Components of batteries

Unit-4

Electrometallurgy and Electroplating **7 Hrs**

Electrowinning and electro refining of Cu and Ni, production of aluminium - Hall-Heroult process - Electrolytic production of magnesium and sodium - Electroplating operations - preplating operations - precious metal plating - anodizing of Al.

Self study: Electroplating of nickel and chromium

Unit-5

Corrosion and Corrosion Control **8 Hrs**

Thermodynamics of corrosion – Pourbaix diagrams – kinetics of corrosion – evans diagram – corrosion current and corrosion potential – Metal oxidation – atmospheric corrosion – crevice corrosion – bimetallic corrosion – stress corrosion – cracking – corrosion control and corrosion inhibitors –cathodic protection – protection by sacrificial anodes.

Self study: Painting for corrosion control

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=Y5JcWEd4Mws
https://www.youtube.com/watch?v=lrdeauk2QUI&t=233s
https://www.youtube.com/watch?v=1EWiEENa4Gs
https://www.youtube.com/watch?v=hKVXo4rgLIc
https://www.youtube.com/watch?v=0G_aqTI9Oos
https://www.youtube.com/watch?v=0P61i7jBitE
https://www.youtube.com/watch?v=A_rI9rNVgR8
https://www.youtube.com/watch?v=HHgPBMMZ26w
https://www.youtube.com/watch?v=YDeqYSNB_eU
https://www.youtube.com/watch?v=5bEdD3zKm1o
https://www.youtube.com/watch?v=NClagKbLUMM
https://www.youtube.com/watch?v=5kmVun3q34U

Text books :

1. Glasstone. S, (2011), *Introduction to Electrochemistry*, 10th Printing, EastWest Press Private Ltd.

2. Bard and Faulkner. (2001). *Electrochemical Methods*. 2nd edition,John Wiley and sons.

3. Bockris and Reddy. (2002). *Modern Electrochemistry*, (Vol. II). 2nd edition, Kluwer academic publishers.

4. Jain and Jain. (2005). *Engineering Chemistry*. 15th edition, Dhanpat Rai Publishing Company.

Reference books:

1. Pletcher. (1990). *Industrial Electrochemistry*. 2nd edition, Chapmann and Hall.
2. Banerjee. (1985). *Introduction to the Science of Corrosion and its Inhibition*. Oxonian Press.
3. Raj Narayanan, (1998), *An Introduction to Metallic Corrosion & its Prevention*, 1stEdn., Oxford & IBH Publishing Co., Pvt Ltd.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	H	S	S
CO2	S	S	H	S	S
CO3	S	S	H	S	S
CO4	S	S	H	S	S
CO5	S	S	H	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY2E2**	***Major Elective - I Food Science and Technology**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	3	**Total Hrs: 39 Hrs**	**Credits:**	3

Course Objective

- To enable the students understand the effect of various methods of food processing.
- To knowledge about the structure and composition of food materials.
- To identify different cooking methods and common adulterants in foods.

Course Outcomes (CO)

K1	CO1	Understand the outlines of cereal and pulse processing technology.
K2	CO2	Describe the importance of nutrients in milk, fruits and vegetables.
K3	CO3	Comprehend the nutritive value of fleshy foods.
K4	CO4	Recognize the composition of sugar, spices, nuts and oilseeds.
K5	CO5	Detect the food adulterants and control process.

Unit I

Physico-chemical properties of foods **10Hrs**

Moisture in Foods, Hydrogen Bonding, Bound Water, Water Activity in Foods, Determination of Moisture Content in Foods, True Solutions, Dispersions, Sols, Gels, Foams.

Cereals and millets

Structure, nutritive value, processing outlines of some common cereals (rice, wheat).Pulses: structure and composition of pulses, toxic constituents in pulses, processing of pulses-soaking, germination, Malting.

Self study: Colloids and Emulsions

Unit II

Vegetables, Fruits and Milk **7Hrs**

Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments. Milk and milk products, composition, nutritive value, properties.

Self study: Processing of milk

Unit III

Fleshy Foods **8Hrs**

Egg: structure, composition, nutritive value, measures of quality. Meat: Structure, composition, classification, nutritive value, tenderization and curing of meat; Poultry: composition, classification, nutritive value and processing.

Self study: Fish: composition, classification, nutritive value

Unit IV

Sugar, Fats and Oil Seeds **7Hrs**

Sugar - composition, nutritive value, stages of sugar boiling. Nuts and oilseeds: classification, composition, nutritive value, uses of nuts and oilseeds.

Self study: Spices and condiments: types, functions and uses.

Unit V

Food Additives **7Hrs**

Introduction, need of food additives in food processing and preservation.Characteristics and classification of food additives.

Antimicrobial agents - Nitrites, sulphides, sulphurdioxide, sodium chloride,hydrogen peroxide.

Antioxidants - Introduction, mechanism of action, natural and synthetic antioxidants, technological aspect of antioxidants.

Sweeteners- Introduction, importance, classification- natural and artificial, chemistry-technology and toxicology, consideration for choosing sweetening agents. Colors- Introduction, importance, classification- natural, artificial, and natural.

Self study: Control of common food adulterants

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Text books:

1. Shakuntala Manay, Shadaksharaswamy. M (2017),*Foods, Facts and Principles*, New Age International Pvt Ltd Publishers, 2nd Edition
2. Chandrasekhar, U. (2002), *Food Science and applications in Indian Cookery*, Phoenix Publishing House, New Delhi
3. Swaminathan, M.(2015),*Food ScienceChemistry and Experimental Foods*, Bappco Publishers, Bangalore.

Reference books:

1. Srilakshmi,B. (2015),*Food Science*, New age International P. Ltd, New Delhi.

2. Williams, Mc. (2007),*Food Fundamentals*, John Willey and sons, New York.

3. Mahindru, S.N. (2009),*Food Science and Technology*, Hardbound P.Ltd, New Delhi.

4. Norman N. Potter (2009),*Food Science*,FifthEdition, Springerlink, Newyork.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	H	S	H	S
CO2	S	H	S	H	S
CO3	S	H	S	H	S
CO4	S	H	S	H	S
CO5	S	H	S	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Ms. R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY2N1**	***Non Major Elective-I Chemistry in Mankind**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	1	**Total Hrs:13 Hrs**	**Credits:**	2

Course Objective

- After completion of the course the students should have to understood industrial preparations of materials of application in day today life.
- To get an awareness about eco-friendly products to lead sustainable life.
- To enable the student to understand about the manufacture of commercial products.

Course Outcomes (CO)

K1	CO1	Remember fundamental concepts of applied chemistry
K2	CO2	Understand the drugs used in day to day life.
K3	CO3	Test the various forms of drugs, cosmetics and milk products in day to day life.
K4	CO4	Predict the knowledge about the paints and cleansing agents
K5	CO5	Analyze the composition of fertilizers, pesticides and milk products.

Unit-1

Food and Medicines **3 Hrs**

Medicines - Antacid - Tranquilizers (Psychotherapeutic Drugs) – Analgesics – Antipyretics – Antimicrobials – Antibiotics – Antiseptics – Disinfectants

Chemistry in Food and Cosmetics - Artificial Sweetening Agents - Food Preservatives

Self study: Analysis of pesticides and heavy metals, other adulterant

Unit-2

Fertilizer and Pesticides **3 Hrs**

Fertilizer type- *need for fertilizers*- essential requirements-NPK ratio-sources of fertilizers. Effect of nitrogen, potassium and phosphorous on plant growth.

Pesticides -classification of insecticides, fungicides, herbicides as organic and inorganic - general methods of application and toxicity,Identification of pesticides in food.

Self study: Safety measures when using pesticides

Unit-3

Paints **2 Hrs**

Paints, varnish and lacquers- ingredients, characteristics and their uses.

Chemistry in Colouring Matter - Classification of Dyes on the Basis of Constitution.

Self study: Classification of Dyes on the Basis of Application

Unit-4

Cleansing agents **2 Hrs**

Cleansing agents - Soaps - classification, manufacture, dry cleaning-properties.

Self study: Cleansing agents- importance of cleansing

Unit-5

Milk and Milk products **3 Hrs**

Milk and Milk products-composition of Milk; Flavour and aroma of Milk; Physical properties of Milk; milk products; Cream; butter; ice Cream; milk powder.

Self study: Effect of heat on Milk; pasteurization; Homogenization

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=Pm9pZlwQAu8

https://www.youtube.com/watch?v=uKEwzpcqXVI

https://www.youtube.com/watch?v=qMhLFu8v4H4

https://www.youtube.com/watch?v=T2d2Jsmu430

https://www.youtube.com/watch?v=VeOBt2PG4SA

Textbooks:

1. Jayashree Ghosh, S.(2005), *Fundamental Concepts of Applied Chemistry*, Chand, Publications.

Reference books:

1. Ronald Bailey, Herbert Clark, James Ferris, Sonja Krause, Robert Strong (2001),*Chemistry of the environment* 2nd Edition Elsevier publications.
2. Jain.P.C. and Monica Jain (2005),*Engineering chemistry* 17th Edition, Dhanpat Rai, Publishing Company (P) Ltd.
3. http://www.ncerthelp.com

Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	H	S	H
CO2	S	S	H	S	H
CO3	S	S	H	S	H
CO4	S	S	H	S	H
CO5	S	S	H	S	H

4. S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms.K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY2N2**	***Non Major Elective-II Chemistry In Context**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	1	**Total Hrs:13 Hrs**	**Credits:**	2

Course Objective

- To enable the student to understand about ecological systems.
- To gain knowledge about biological effects, energy sources and plastics.
- To get an awareness about eco-friendly products to lead sustainable life.

Course Outcomes (CO)

K1	CO1	Remember different types of pollution
K2	CO2	Understand harmful effects of air pollution, applications of solar energy and nuclear energy.
K3	CO3	Implement the disposal of plastics.
K4	CO4	Analyze the hazards of air pollution and radioactivity
K5	CO5	Implement to reduce global warming.

Unit-1

Composition of Environment **3 Hrs**

Environment segment- The atmosphere- the air we breathe - composition of air - burning of hydrocarbons - fog - air quality - ozone - oxygen / ozone screen - ozone formation and distribution in the atmosphere - paths of ozone destruction - chlorofluorocarbons and their interactions with ozone - the antartic ozone hole.

Self study: Biological effect of UV radiation

Unit-2

Global warms **3 Hrs**

Chemistry of global warms - earth's energy balance - vibrating molecules and the green house effect - molecular response to radiation - methane and other green house gases - climate modeling.

Self study: Green house effect

Unit-3

Renewable energy **3 Hrs**

Solar energy - fuel from sun light - splitting of water - hydrogen from sunlight - hydrogen economy - fuel cells - batteries.

Self study: Photovoltaics - stealing the sun

Unit-4 **2 Hrs**

Non-renewable energy

Nuclear energy - nuclear fission and fusion - production of electricity by a nuclear reactor - radioactivity - living with nuclear power.

Self study: Hazards of radioactivity

Unit-5

Plastics and polymers **2 Hrs**

The world of plastics and polymers -3R principle-Reduce, Reuse and Recycle- polymers - polyethylene - plastics and recreation - paper or plastics.

Self study: disposal of plastics

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Textbooks:

1. Jayashree Ghosh, S. (2005),*Fundamental Concepts of Applied Chemistry*, Chand, Publications.

Reference books:

1. Conard L. Stanitski. Luey Pyrde Eubenks. Catherine H. Middle Camp and Wilmer J. Stratton (2000),*Chemistry in Context: Applying Chemistry to Society*, 3rd Edition, Tata Mc Graw Hill.
2. Bailey, Clark, Ferris, Isrause, Strong, (2001),*Chemistry of the environment* 2nd Edition Elsevier publications.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	H	H	S
CO2	S	S	H	H	S
CO3	S	S	H	H	S
CO4	S	S	H	H	S
CO5	S	S	H	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. M. Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R.Muthukumaran Signature:

Programme	M.Sc.	**Programme Title :**	Master of Chemistry

code:				
Course Code:	**20PCY207**	**Inorganic Chemistry Practical –I**	**Batch :**	2020-2022
			Semester	I &II
Hrs/Week:	5&4	**Total Hrs: 117 Hrs**	**Credits:**	3

Course Objective

- To enable the students to separate the common and rare cations in a mixture
- To characterize two common and two less familiar cations
- To prepare inorganic complexes.

Course Outcomes (CO)

K3	CO1	Remember the analysis of cations alone.
K4	CO2	Separate common and rare cations
K5	CO3	Analyse and report cations in a mixture
K5	CO4	Prepare and report coordination compounds
K5	CO5	Develop skills in the synthesis of inorganic complexes.

A. Semimicro QualitativeAnalysis:

Qualitative Analysis employing semi micro methods & spot tests of mixtures of common cations & ions of the following less familiar elements.

Less Familiar Cations:

Molybdenum, Uranium, Thorium, Tungsten, Selenium, Cerium, Titanium, Zirconium, Vanadium & Lithium.

Familiar Cations:

Lead, Copper, Bismuth, Cadmium, Nickel, Manganese, Zinc, Barium, Strontium, Calcium, Ammonium, Magnesium

Note: A minimum of FIVE inorganic mixtures, each containing of two familiar and two less familiar metal cations has to be analyzed by each student during the course.

B. Preparation of Inorganic Complexes

Any Five preparations selected from the following list:

Hydroxylamine hydrochloride,
Chrome alum Copper(I)Chloride,
Trithio urea copper(I),
Potassium trioxalatochromate(III),
Potassiumtrioxalatoferrate(III),
Hexaminecobalt(III)chloride,
Chloropentamminechromium(III)chloride,
Tetrammine copper(II) Sulphate,
Ammonium hexachloro stannate (IV).

Reference books:

1. Ramanajum V.V, (1985) *Semimicro Qualitative Inorganic Analysis*.
2. VenkateswaranV, Veeraswamy R and Kulandaivelu A.R, (1997) *Principles of Practical Chemistry Sultan* Chand & Sons. 2nd Edition.
3. Giri. S. Bajpai D.N. & Panday, O.P. (1990). *Practical Chemistry* Vol. I & II, S. Chand & Co.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	H	S	H	S	S
CO2	H	S	H	S	S
CO3	H	S	H	S	S
CO4	H	S	H	S	S
CO5	H	S	H	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY208**	**Organic Chemistry Practical -I**	**Batch :**	2020-2022
			Semester	I &II
Hrs/Week:	5& 4	**Total Hrs: 117 Hrs**	**Credits:**	3

Course Objective

- To enable the students to separate two components in an organic mixture
- To identify the separated components by qualitative tests
- To prepare organic compounds

Course Outcomes (CO)

K3	CO1	Remember the analysis of organic compounds and aromatic substitution reactions.
K4	CO2	Separate organic mixtures by solvent extraction.
K5	CO3	Analyze organic compounds
K5	CO4	Develop skills in the synthesis of organic compounds
K5	CO5	Determine boiling point /melting point

A. Analysis of two component organic mixtures.

(Separation and characterization of individual compounds)

Note: Each student has to complete the analysis of minimum of FIVE Mixtures during the course

B.Single stage Preparationsand Recrystallisation (Any Five)

1. **Hydrolysis:**
   Preparation of Benzoic acid from Benzamide.
2. **Acetylation:**
   Preparation of Acetanilide from Aniline.
3. **Bromination:**
   Preparation of p-Bromoacetanilide from Acetanilide.
4. **Nitration:**
   Preparation of m-dinitrobenzene from Nitrobenzene.
5. **Benzoylation:**
   Preparation of Benzanilide from Aniline.
6. **Oxidation:**
   Preparation of Benzoic acid from Benzaldehyde.
7. Preparation of Glucose penta acetate

C. Demonstration only

1. Thin Layer Chromatography
2. Melting point of synthesized compounds

Reference books:

1. Gnanaprakasam and Ramamurthy (1998),*Organic Chemistry Laboratory Manual*, Ananda Book Depot,Chennai.
2. Vishnoi N.K (2001). *Advanced Practical Organic Chemistry*, Vikas Publishing House.
3. Jagmohan. R (2002). *Advanced Practical Organic Chemistry*, Vol. I &II.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
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CO3	S	S	S	H	S
CO4	S	S	S	H	S
CO5	S	S	S	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. V. Prabhu Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY209**	**Physical Chemistry Practical -I**	**Batch :**	2020-2022
			Semester	I &II
Hrs/Week:	5&4	**Total Hrs: 117 Hrs**	**Credits:**	4

Course Objective

- To make the students to understand the principle and to carry out the potentiometric titrations.
- To determine the pH and P^{Ka} values of buffers and acids
- To determine the molecular weight of solutes.
- To construct the Phase diagram of two components systems

Course Outcomes (CO)

K3	CO1	Recollect the concept of potentiometric titration. .
K4	CO2	Understand the simple eutectic system, molecular weight determination by Rast method, partition coefficient and estimation of metal ions using colorimetry.
K4	CO3	Examine the strength of the solutions and Ka values by potentiometry
K5	CO4	Calculate the molecular weight of chemical compounds from $K_f$values by Rast micro method.
K5	CO5	Estimate the metal ions using colorimetry.

Non Electrical Experiments

1. **Properties of Matter**
   Simple Eutectic System- determination of unknown compositions

2. **Molecular weight determination**
   Determination of Molecular weight by Rast's micro method

3. **Partition coefficient**
   Determination of Equilibrium constant for the reaction
   $KI + I_2 \leftrightarrow KI_3$

Electrical Experiments -Potentiometric Titrations:

A. Acid-Base titrations (using quinhydrone electrode)

4. Titration of Strong acid against Strong base
5. Titration of Weak acid against Strong base
6. Titration of mixture of (strong & weak) acids against Strong base
7. Determination of P^H (acidic solutions)
8. Determination of P^{Ka} of weak acid
9. P^H, P^{Ka} for Phosporic acid

B.Redox titrations

10. Titration of Potassium Iodide against Potassium Permanganate
11. Titration of Ferrous Ammonium Sulphate against Potassium dichromate

C. Precipitation titrations (using silver electrode)

12. Titration of Potassium chloride against Silver nitrate
13. Titration of mixture of halides (chloride and iodide) against silver nitrate

D. Colorimetric Estimations (using photoelectric colorimeter)

Estimation of Copper, Iron, Nickel, Manganese and Chromium.

Reference books:

1. Palit S.R and De S.K (2003),*Practical Physical Chemistry*, Science Book Agency, Calcutta.
2. Sharma P.C and Agarwal (1996),*Practical Chemistry*, Goel Publishing House, Meerut.
3. Venkateswaran Vand Kulaindaivelu A.R (1987),*Practical Physical Chemistry* S.Chand & Co.

Mapping

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CO4	S	S	S	S	H
CO5	S	S	S	H	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY310**	**Organic Chemistry –III – Natural Products and Organic Reagents**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	5	**Total Hrs:65 Hrs**	**Credits:**	5

Course Objective

- To promote an awareness in the student about natural products and their synthesis.
- To introduce new reagents available in organic synthesis.
- To synthesize eco-friendly reagents and chemical pathways for the development of green chemistry

Course Outcomes (CO)

K1	CO1	Remember the classes of natural products and the fundamental of condensation and molecular rearrangement reactions.
K2	CO2	Understand isolation, classification and structural elucidation of terpenoids, steroids and naming reactions which includes condensation, molecular rearrangements.
K3	CO3	Implement the biosynthetic idea of proteins and polypeptides.
K4	CO4	Apply the reagents in organic synthesis.
K5	CO5	Predict the reagents involved in organic synthesis and retro synthesis.

Unit-1

Terpenoids **13 Hrs**

Structural elucidation and synthesis of zingiberene, eudesmol, abeitic acid and caryophyllene, α-pinene, α-santonin, Linalool.

Self study: Introduction - Isolation and classification of terpenoids - isoprene rule, gem-dialkyl rule

Unit-2

Steroids **13 Hrs**

Structural elucidation of cholesterol (synthesis not required), ergosterol, Vitamin-D, Bile acid, testosterone and progesterone.

Self study: Introduction-steroids

Unit-3

Proteins and Polypeptides **13 Hrs**

N- terminal(Hydrazinolysis, reduction and carboxypeptidase methods only) and C- terminal residue analysis (phenylthiohydantoin, cyanate and DNP methods only)

Synthesis of polypeptides (Sheehan's, Halpen's and Fischer's methods only), - structure of DNA and RNA and their biological importance.

Heterocyclic compounds: Structure, synthesis and reactions of flavones, isoflavones, purines (adenine and guanine) and anthocyanins (cyanin and pelargonin) thymine, uracil, cytosine.

Self study:Introduction- Primary, secondary and tertiary structures of proteins Enzymes and biosynthesis of proteins, application of catechin, kaempferol and quercetin.

Unit-4

Molecular rearrangements **13 Hrs**

Introduction - Wagner - Meerwein rearrangements, dienone phenol, Wolf, Favorski, Neber rearrangement, Baeyer-Villiger rearrangement, Stevens, Chapman, Benzidine, Fries, Ardnt Eister synthesis, Lossen and Wallac rearrangements, Curtius, Hoffmann- Lofller- Freytag, Demjanov, Von-Richter rearrangement, Sommelet-Hauser rearrangement, Smiles rearrangement

Self study: Condensation reactions

Unit-5

Reagents in organic synthesis **13 Hrs**

Gilmans reagent, lithium di-methyl cuprate, lithium diisopropyl amide (LDA), trimethyl silyl iodide, Peterson's synthesis, Vilsmeier reaction. Preparations and synthetic applications of DBU (1,5-diazabicyclo[5.4.0] undecene-5), DCC (dicyclohexylcarbodiimide) , NBS, PCC, PDC, Wilkinson's catalyst. Retro synthetic Analysis - use of activation and protecting groups in synthesis

Self study: Retro synthetic analysis of simple organic compounds.

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://youtu.be/pel8P2atSEg
https://youtu.be/sdN9LgeKLAo
https://youtu.be/diksW7rHXms
https://youtu.be/AYB_E9gdzx0
https://youtu.be/nm0rkDiobvc
https://youtu.be/baAaUzf_psy
https://youtu.be/2DyeKE5q8Go

Textbooks:

1. Finar. I. L (1998), *Organic Chemistry Vol. II*, Longman Publishing Group.
2. Agarwal O. P (2001), *Natural product Chemistry*, 20th Edition, Goel Publishing house.
3. Gurdeep Chatwal (2001), *Organic Chemistry of Natural Products Vol I& II*, Himalaya Publishing House.
4. Ahluwalia, V.K. Rakesh K. Parashar (2010), *Organic Reaction Mechanism*. 4th Edition, Narosa Publsihing House.

5. Stuart Warren. (1994). *Designing Organic Syntheses.* 1st edition. John Wiley and sons.
6. Bansal,R. K, (2006), *Organic reaction mechanism* , 11th Ed, Tata McGraw-Hill, Noida.

Reference books:

1. Jerry March (2007), *Advanced organic chemistry*, 4th Edition, A Wiley-Interscience.
2. Newman, A.A (1972, *Chemistry of Terpenes and Terpenoids,* Academic press publishers.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	H	S	S
CO2	S	S	H	S	S
CO3	S	S	H	S	S
CO4	S	S	H	S	S
CO5	S	S	H	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY311**	**Physical Chemistry –III Thermodynamics and Catalysis**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	5	**Total Hrs: 65 Hrs**	**Credits:**	5

Course Objective

- To enable the students to understand and apply the concept of fugacity, activity and chemical potential
- To acquire knowledge on third law of thermodynamics and probability and ensembles.
- To gain knowledge about the distribution laws (classical and statistical) and their applications
- To understand the fundamentals of Surface chemistry.

Course Outcomes (CO)

K1	CO1	Remember the fundamentals of thermodynamics and surface chemistry.
K2	CO2	Comprehend the quantum statistics and partition function.
K3	CO3	Calculate the molecular velocities based on Maxwell Boltzmann distribution law.
K4	CO4	Apply thermodynamic concepts to evaluate the relationship between thermodynamic properties.
K5	CO5	Evaluate statistical thermodynamics to the properties of identical indistinguishable particles like electrons.

Unit-1

Themodynamics and Non-ideal systems **13 Hrs**

Review of the laws of thermodynamics – free energy, chemical potential, entropy-Fugacity - determination of fugacity of gases by graphical method, approximate calculation method, generalized method and from equations of state. Variation of fugacity with temperature and pressure. Fugacity of a gas in a mixture of real gases - Lewis Randal rule.

Definition of activity - activity coefficient of a gas - relation between fugacity and activity coefficient of gas - variation of activity of a gas with temperature and pressure.

Self Study: Activity and activity coefficient of solutions-mean activity and mean activity coefficient

Unit-2

Third Law of Thermodynamics **13 Hrs**

Probability and third law - Nernst heat theorem, thermodynamic quantities at absolute zero, helium at low temperature-negative absolute temperature - entropy of gases - entropy at absolute zero - entropy and probability (Boltzmann Expression) - Boltzmann - Planck equation - significance of thermodynamic probability - entropy of expansion of ideal gas.

Mathematical Introduction: Theories of permutation & combination - laws of probability - Gaussian distribution.

Self study: Need for third law

Unit-3

Statistical Thermodynamics **13 Hrs**

Introduction - combination and permutation laws – Macroscopic and microscopic probabilities- distinguishable and indistinguishable objects - Maxwell - Boltzmann statistics – Fermi-Dirac statistics- Bose-Einstein statistics- thermodynamic probability- Boltzmann expression for entropy - Stirling's approximation - States of maximum thermodynamics probability - Legrangian multipliers - Maxwell - Boltzmann distribution law - Evaluation of alpha and beta in M.B. distribution law.

Self study: Thermodynamic probabilities of systems in equilibrium

Unit-4

Partition function **13 Hrs**

Partition function – canonical ensembles - Molecular partition function and canonical function - evaluation of translational, rotational and vibrational partition function – Evaluation of E, Cv and entropy from the partition functions - The relation between partition function and thermodynamic function (E, H, S, A, G, Cv and Cp) - ortho and para hydrogen.

Self study: Study of monoatomic and diatomic ideal gas molecule on the basis of partition functions

Unit-5

Catalysis **13 Hrs**

Catalysis- acid-base catalysis - enzyme catalysis - Michaelis-Menten equation - effect of temperature on enzyme catalysis - heterogenous catalysis - kinetics of heterogeneous catalysis - Langmuir- Hinshelwood, Rideal - Eley mechanism - pH dependence of rate constants of catalyzed reactions - auto catalysis and oscillatory reactions.Surface phenomenon - physisorption and chemisorptions - applications - factors influencing adsorption - adsorption isotherms: Langmuir, Freundlich, BET and Gibbs adsorption isotherm - measurement of surface area.

Self study:Catalysis- Characteristics

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=UIVJ4JkqjaI

https://www.youtube.com/watch?v=NrtZAJtEH3c&list=PLdBDmcnzLC_ZfA9evETgll7NX6N_45M77

https://www.youtube.com/watch?v=ogw0iojLBEQ

https://www.youtube.com/watch?v=1yf2LBUb39g

https://www.youtube.com/watch?time_continue=506&v=Lz0xqu3HvD0

Textbooks:

1. Puri B.R & Sharma. L R (2009), *Advanced Physical Chemistry*, 2nd Edition., Milestone Publishers & Distributors.
2. Bajpai, D.N. (1992), *Advanced Physical Chemistry,* 1stEdition Reprint (2015) S. Chand Publishing Limited.
3. Gupta, M.C. (1990), *Statistical thermodynamics*,1st Edition, Wiley Eastern Limited.
4. Rajaram Kuriacose (2006), *Statistical thermodynamics*, 4th edition, Shoban lal & Co.
5. Gurudeep Raj (2016). *Chemical Kinetics*, 40th Edition, Krishna Educational Publishers.

Reference books:

1. Aktins. P. W, (1978), *Physical Chemistry*, 1stEdition,Oxford University
2. Klotz, L. M, Rosenberg R.M. & Benjamin, W.A (1974), *Chemical thermodynamics*, 3rd Edition, Pearson publications.
3. Samuel Glasstone, (1964), *Thermodynamics for chemists,* 2nd Edition Reprint (2002), Van Nostrands.
4. Nash, L.K. (1976), *Chemical Thermodynamics*, 2nd Edition, Addision Wesley Publishing.
5. Gabor A. Somorjai and Yimin Li (2010),*Introduction to Surface Chemistry and Catalysis*, 2nd Edition,Willey Publishers.
6. Adamson, A.W, (1997),*Physical Chemistry of Surfaces*, 6th edition, Wiley

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	H	S	H	S
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CO3	S	H	S	H	S
CO4	S	H	S	H	S
CO5	S	H	S	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name:R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY312**	**Spectroscopic Techniques-Application in Organic Chemistry**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	5	**Total Hrs: 65 Hrs**	**Credits:**	5

Course Objective

- To enable the students to understand the principles and instrumentation of various spectroscopic techniques.
- To learn the applications of NMR spectra.
- To acquire knowledge in the structural determination of unknown compounds and various spectroscopic methods.
- To apply the spectral techniques in research.

Course Outcomes (CO

K1	CO1	Remember about electromagnetic radiation and its frequency region.
K2	CO2	Analyze the vibrations of molecules and identify the functional group present in it.
K3	CO3	Predict the structure of compound using 1D and 2D NMR techniques.
K4	CO4	Describe the mass to charge ratio for the sample under test and to propose the fragmentation pattern.
K5	CO5	Interpret and solve structural problems using various spectra.

Unit-1

UV Visible Spectroscopy13 Hrs

Introduction to spectroscopy - Properties of electromagnetic radiation- Electromagnetic spectrum

Simple chromophoric groups- auxochromes - effects of conjugation - Woodward - Fischer rules - aromatic system and systems with extended conjugation –λ_{max} calculation of butadiene and carbonyl compounds- applications to organic compounds - instrumentation.

Self study: Absorption and emission spectra

Unit-2

IR Spectroscopyand Raman spectra 13Hrs

The vibrating diatomic molecules - the simple harmonic oscillator- the diatomic rotator - vibrations of polyatomic molecules - the influence of rotation on the spectrum of polyatomic molecules - factors influencing vibrational frequencies - characteristic group absorptions of organic molecules- finger print region -identification of functional groups - applications to simple organic molecules -medical diagnosis (cancer)- instrumentation- FT- IR,NIR

Raman spectra – introduction – characteristic properties of Raman lines – differences between Raman spectra and IR spectra – mechanism of Raman Effect – Intensity of Raman lines

Self study: Applications of Raman spectroscopy

Unit-3

Mass Spectrometry **13 Hrs**

Theory - *instrumentation* - isotopic abundance - determination of molecular weights and formula, ionisation techniques (CI, FD, FAB & ESI, APCI) - nitrogen rule -metastable ions and peaks - ion fragmentation mechanisms - Retro Diels-Alder rearrangement -Mclafferty rearrangement -elimination due to ortho groups. Fragmentation associated with functional groups - benzyl alcohol, phenol, methyl phenyl ether, benzaldehyde, 2-hexanone, benzoic acid, n-propyl ethanoate, and benzamide.

Self study: HR-MS,MS-MS, HREMS.

Unit-4

Nuclear Magnetic Resonance Spectroscopy -^{1}HNMR **13 Hrs**

Magnetic properties of nuclei - theory of nuclear resonance - chemical shift and its measurement - factors influencing chemical shift - chemical equivalence and magnetic equivalence - solvents and NMR spectra - spin-spin coupling, spin-spin splitting systems - proton exchange reactions - heteronuclear coupling - deuterium exchange - double resonances - chemical shift reagents - applications to organic compounds.

Self study: Instrumentation - CW and FT NMR

Unit-5 **13 Hrs**

^{13}C NMR: Magnetic moment and natural abundance- broad band decoupling - Off-resonance decoupling - deuterium coupling - NOE effect- - peak assignments using DEPT spectrum - structural applications of simple organic molecules.

2D NMR Techniques: Theory - ^{1}H-^{1}H COSY, ^{1}H-^{13}C COSY: HETCOR, Proton detected HETCOR: HMQC, HMBC, NOESY.

Solving problems using IR, UV, NMR and mass spectra for simple molecules.

Self study: Magnetic moment and natural abundance

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/results?search_query=https%3A%2F%2Fwww.khanacademy.org%2Fscience%2Forganic-chemistry%2Fspectroscopy-jay

https://www.youtube.com/watch?time_continue=1153&v=bEzlTtaEfDU

Text Books:

1. Sharma, Y.R. (2005), *Elementary Organic Spectroscopy,* 3rd Edition, S. Chand & Company Ltd.

2. Banwell. C.N. (1994), *Fundamentals of molecular spectroscopy*, 3rd Edition, Tata McGraw Hill Publishing Company Ltd.
3. Kemp, W. (1991), *Organic Spectroscopy*, 3rd Edition, Mc Millan Press Ltd.
4. Jagmohan, (2005) ,*Organic Spectroscopy Principles and Applications*, 2nd Edition , Narosa publishing house.
5. Kalsi, P.S. (2004), *Spectroscopy of Organic Compounds*, 6th Edition, New Age International Publishers.

Reference Books :

1. Dyer, J. (1965), *Application of absorption spectroscopy of organic compounds*, Prentice and Hall of India Pvt., New Delhi.
2. Silverstien, Bassler and Morril, (2014), *Spectrometric identification of organic compounds*, 8th Edition, John Wiley and Sons, INC

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
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CO3	S	S	S	L	S
CO4	S	S	S	L	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: R.Mini, M.Anusuya K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY3E3**	**Major elective-II Research Methodology & Cyber Security**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	4	**Total Hrs:52 Hrs**	**Credits:**	3

Course Objective

- To develop skills in formulating various research designs.
- To learn the application of technology in research.
- To gain knowledge about the use of tools and software in research
- This course presents the principles of Cyber Security and its attack.
- It covers all aspects of cyberspace, botnet, cybercrime and its case studies

Course Outcomes (CO)

K3	CO1	Familiarization of various research concepts
K4	CO2	Knowledge on formulating research designs
K5	CO3	Ability to write a good research report
K5	CO4	To get the idea about cyber security.
K5	CO5	To gain knowledge of legal and ethical issues for cybercrime.

Unit –I

Concept of Research **10 Hrs**

Importance of research in science, Criteria of good research, Qualities of a good researcher. Sources of a research problem. Types of research - Basic, applied, action, experimental, diagnostic and exploratory.

Self study: Definitions, objectives, characteristics of research

Unit II

Components of Research Design **11 Hrs**

E-journals, N-list-journals, plagiarism, Intellectual property rights, Web of science, Scopus, Science citation index.Problem selection- literature survey- primary sources - journals, patents, journals of different fields of chemistry (organic, inorganic, physical, polymer, analytical and nano) - secondary sources- books, indexes, chemical abstracts, review articles - literature searching online, patent-patent filling,

Self study:H – Index, I-10 Index

Unit –III

Scientific Writing **11 Hrs**

Nature and purpose, the components of dissertation and Research paper, overview, title and title page, abstract, preface and table of contents. Introduction, objectives, experimental section results, discussion, conclusion, references-different styles, Zotero, Endnote and Mendeley and miscellaneous components.

Materials, Tools and Methods in Scientific Writing

Writing techniques – Introduction, word processing and page layout, hardware and operating systems, word processing and page layout software, writing and formatting with computer, becoming accustomed to your system.

Self study: Chem draw, Orgin, Excel.

Unit-4

Over view of cyber security **10 Hrs**

Confidentiality, integrity and availability **Threats:** Malicious software (viruses, Trojans, root kits, worms, botnets), Memory exploits (buffer overflow, heap overflow, integer overflow, format string).

Self study: Cryptography- Authentication, password system- windows security

Unit-5 **10 Hrs**

Network security: Network intrusion detection and prevention system, firewalls.

Software security: Vulnerability auditing, penetration testing, sandboxing, control flow integrity – **web security**: user authentication- Legal and ethical issues: trade secret, hacking and intrusion, privacy, identity theft.

Self study: Legal and ethical issues: Cybercrime, intellectual property rights, copy right, patent

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=Yzfl3rtF0SM

https://youtu.be/ooJSgsB5fIE

https://youtu.be/iy_h0tr_CMc

https://youtu.be/E03gh1huvW4

https://www.youtube.com/watch?v=mAVswCbzjM

https://youtu.be/_zq4qTc9Jmg

Text Books:

1.Saravanavel, P., Kitab Mahal, *Research Methodology,* AllahabadInternational Publishers.

2. Hans F. Ebel, Claus Bliefert, (2005), *The Art of Scientific Writing*,2nd Edn, Wiley Publishing

3. Arthur Conklin, W.M., Greg White, T.M.H, "*Principles of Computer Security*"

Reference Books:

1. Kothari, C.R, (2011), *Research Methodology - Methods and Techniques*, 2nd Edn, New Age
2. Singh, Y.K, Nath, R., (2005), *Research Methodology*, 1st Edn, APH Publishing Corporation.
3. Santhosh Gupta, *Research methodology and statistical techniques*, Deep & Deep Publications, New Delhi.
4. Chwan- Hwa (John) Wu, J.David Irwin,(2016), *Computer Networks & Cyber security*, CRC Press.
5. Mike O'Leary,(2016),*Cyber O*– Apress Publications
6. Jeff Kramer, Nicolas Burrus, Florian Editler, Matt Parker,(2016), *Hacking the Kinect*, Technology in cation Publications.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	H	S	H
CO2	S	S	H	S	H
CO3	S	S	H	S	H
CO4	S	S	H	S	H
CO5	S	S	H	S	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. K. Poonkodi Dr. V. Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY3E4**	***Major Elective- II Industrial Chemistry**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	4	**Total Hrs: 52 Hrs**	**Credits:**	3

Course Objective

- To gain knowledge about the manufacture of sugar, glass, cement and varnishes
- To understand the properties of glass, cement and rubber
- To learn the chemistry of paints
- To know the applications of glass, cement and rubber

Course Outcomes (CO)

K3	CO1	Remember the manufacture of sugar, varnishes, glass and cement.
K4	CO2	Analyze the constituents and setting of paints.
K5	CO3	Examine the properties of sugar, paint, varnishes, glass, cement and rubber.
K5	CO4	Generalize the vulcanization techniques of rubber.
K5	CO5	Appraise the importance of Plaster of Paris and Gypsum.

Unit I **11Hrs**

Sugar

Introduction, Manufacture of Cane Sugar - Extraction of juice, Purification of Juice, Defecation, Sulphitation, Carbonation, Concentration or Evaporation. Crystallization - Separation of crystals, drying, refining, recovery of sugar from Molasses, Bagasse. Manufacture of sucrose from beet root.

Self study: Estimation of sugar, double sulphitation process, double carbonation

Unit II **11Hrs**

Paints

Classification, constituents, setting of paints, requirements of a good paint. Emulsion, Latex, Luminescent, Fire retardant and Heat resistant paints. Methods of applying paints.

Varnishes

Introduction – Raw materials – Manufacture of varnishes.

Self study: Special applications and failures of paints

Unit III **10Hrs**

Glass

Characteristics of glass. Raw materials, methods of manufacture - formation of batch material, melting, shaping, annealing and finishing of glass.

Self study: Introduction, Physical/Chemical properties of glass

Unit IV **10Hrs**

Cement

Introduction, raw materials, manufacture – Wet process, Dry process, reactions in kiln, setting of cement, properties and uses of cement.

Self study: Plaster of Paris, Gypsum, Lime

Unit V

Industrial Waste Disposal Methods **10Hrs**

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health - Types of waste disposal methods – Landfill - Incineration - Composting.

Self study: Environmental legislations related to prevention and control of industrial effluents and hazardous wastes

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Text Books:

1. Sharma,B. K., (2008). *Industrial Chemistry*, 14th Edition, Goel Publishing House.
2. Eckenfelder W.W. Jr., (2000), "*Industrial Water Pollution Control*", McGraw Hill Book Company, New Delhi.

Reference Books:

1. Jain,P.C.& Monika Jain, (2016), *Engineering Chemistry*, 16th Edition, Dhanpat Rai Publishing Co., (Pvt) Ltd.
2. Parameswara Murthy C., Agarwal,C.,Andhra Naidu,V., (2006), *Text Book of Engineering Chemistry*, 1stEdition. Revised, BS Publications.
3. Freeman H.M., (1995), "*Industrial Pollution Prevention Hand Book*", McGraw Hill Inc., New Delhi.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	H	S	H
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CO4	S	S	H	S	H
CO5	S	S	H	S	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms.R.Mini	Name:Dr.K.Poonkodi	Name:Mr.K.Srinivasan	Name: Dr.R.Muthukumaran

Signature:	Signature:	Signature:	Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY3AL**	**Advanced functional materials**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	**Advanced Learners**		**Credits:**	3

Course Objective

- To provide a comprehensive introduction of molecular level devices, machines.
- To know the structural and biological properties of PAMAM.
- To remember the principles of high temperature superconductors.
- To understand the importance of biodegradable polymers.

Course Outcomes (CO)

K1	CO1	Remember the molecular-level devices and machines
K2	CO2	Familiarize the molecular devices based on various supramolecular interactions
K3	CO3	Propose the synthesis, characterization and application of PAMAM dendrimers
K4	CO4	Interpret the principles underlying the high temperature superconductors and applications of oxide materials
K5	CO5	Analyze the structure and importance of various biodegradable polymers, supramolecular polymers and self-healing polymers

Unit I - Molecular-Level Devices and Machines Molecular machines

Pseudorotaxanes, rotaxanes and catenanes – Systems featuring charge-transfer interactions – systems featuring hydrogen bonding interactions. Devices based on Electronic and Nuclear motion: Plug/socket and related systems – electrochemically controlled systems

Unit II - Poly(amidoamine) Dendrimer-Based Multifunctional Nanoparticles PAMAM Dendrimers:

Structure and biological properties – Synthesis and characterization, PAMAM dendrimers as a vehicle for molecular delivery into cells – PAMAM dendrimers as MRI contrast agents.

Unit III - Advanced functional oxide materials and their applications High temperature superconductors:

Cuprate Materials, Electrical and Magnetic properties - Magnetic oxide materials: Ferromagnetic oxide materials, Ferrites materials - Multiferroic Materials: Origin of magnetic ordering in the oxide materials.

Unit IV - Biodegradable Polymers

Biodegradable polymers - polyε-caprolactone- modified poly ε-caprolactone copolymer with ester, amide and urethane linkages, polyglycolate, polymandelic acid - biodegradable polyamides – polyester urea – polyamide urethane.

Unit V - Smart polymers

Supramolecular polymers - Main chain supramolecular polymers, side-chain supramolecular polymers, examples of stimuli responsive supramolecular polymers, self-healing polymers

Text Books:

1. Fritz Vögtle. J, Fraser Stoddart and Masakatsu Shibasaki, (2000), *Molecular-Level Devices and Machines, In Stimulating Concepts in Chemistry*, pp 255-266, Edition- Wiley-VCH Verlag GmbH, Weinheim,
2. Chad A. Mirkin and Christof M. Niemeyer, (2007), *Poly(amidoamine) Dendrimer-Based Multifunctional Nanoparticles, In Nanobiotechnology II*, Edition -Wiley-VCH Verlag GmbH &Co. KGaA, Weinheim.
3. Lynn. J. W, (1990), *High Temperature Superconductivity*, Springer- Verlag.

ReferenceBooks:

1. Guillet. J, (1973), *Polymers and Ecological problems*, Plenum Press, New York.
2. Schnabel.W, (1981), *Polymer Degradation – Principles and Practical Applications*, Hanser International.
3. Wolfgang H. Binder, (2013), *Self-Healing Polymers via Supramolecular, Hydrogen-Bonded Networks, in Self-healing Polymers: From principles to applications*, Edition- Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	H	S	H	S
CO2	S	H	S	H	S
CO3	S	H	S	H	S
CO4	S	H	S	H	S
CO5	S	H	S	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi	Name:Dr.K.Poonkodi	Name:Mr.K.Srinivasan	Name: Dr.R.Muthukumaran

Signature:	Signature:	Signature:	Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY414**	**Inorganic Chemistry – III – Bioinorganic and Inner Transition Elements**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	5	**Total Hrs: 65 Hrs**	**Credits:**	4

Course Objective

- To allow the students to get introduced to the study of inner transition elements.
- To acquire knowledge in the nature, preparation and properties metal carbonyl complexes, photochemistry of metal complexes.
- To gain knowledge about various applications and the role of metals in biological systems.

Course Outcomes (CO)

K1	CO1	Remember the general properties of Inner Transition elements and applications of inorganic metal complexes in photochemistry.
K2	CO2	Understand the magnetic properties of Inner Transition elements and homogeneous catalysis of organometallic.
K3	CO3	Apply the catalytic property of organometallic in synthesis.
K4	CO4	Analyze the mechanism involved in organometallic and the biological function of essential and non- essentialelements.
K5	CO5	Evaluate the importance of biological function of certain metals.

Unit-1

Chemistry of Inner transition elements **13 Hrs**

Color and complex formation inner transition elements- comparison between‘d’ and ‘f’ block elements - magnetic properties of Lanthanides and Actinides - complex formation and color absorption spectra of lanthanides and actinides. Comparison between lanthanides and actinides.

Self study: Use of lanthanide compounds as shift reagents

Unit-2

Homogeneous catalyst by organometallics **13 Hrs**

Types of reactions in Homogeneous catalyst - olefin hydrogenation, olefin dimerization and metathesis, Monsanto acetic acid synthesis, olefin isomerization, Wacker oxidation of alkenes, hydroformylation, water gas shift reaction, template synthesis, alkene hydrosilation, acetic acid from ethylene. Heterogeneous catalysis - Zieglar- Natta Catalysis.

Self study: Types of reactions in Homogeneous catalyst- Zeise’s salt, Vaska complexes

Unit-3 **13 Hrs**

Inorganic Photochemistry

Introduction, $[Ru(bipy)_3]^{2+}$ complexes in solar energy, Photochemical reactions of metal carbonyls, Photolysis of water. Photochemistry of metal beta diketonates.

Insertion reaction- Introduction - CO insertion and SO_2 insertion reactions - insertion involving alkenes.

Oxidative addition and reductive elimination- Introduction, one-electron oxidative addition-addition of oxygen-mechanism, 5-coordinate 18-electron reactants, 4-coordinate 16-electron reactants, 4-coordinate 18-electron reactants.

Self study: concerted Vs free radical mechanism, reductive elimination

Unit-4

Bioinorganic chemistry:I **13 Hrs**

Essential and non-essential elements, Biochemistry of Sodium and Potassium - The Sodium-Potassium pump - Biochemistry of Calcium-Storage and transport of Calcium-Calmodulin-Muscle constaction and blood clotting-Biochemistry of Copper- Stuctural features of different Copper proteins- Storage and transport of Copper.

Self study: Biological Function and toxicity of Some Elements (Cr, Mn, Co, Ni, Se, Mo, Cd, Pb)

Unit-5

Bioinorganic Chemistry:II **13 Hrs**

Metalloporphyrins (heme and non-heme proteins) - cytochromes, heomoglobin, myoglobin, chlorophyll, ferridoxins, rubredoxins - Vitamin B_{12} and B_{12} coenzymes (structure and functions) - nitrogen fixation (invitro and invivo) - Metallo enzymes – Carboxypeptidase - Metallo drugs for cancer theraphy (Cis-platin).

Self study: Cytochrome-P-450 and Carbonic anhydrase

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=6fRxAjMdMvE&list=PLR-lh4Ip2fLusw2XTKlgOS9c5sGHCDlqW
https://www.youtube.com/watch?v=OgqPPFg4t6s

https://www.youtube.com/watch?v=7qb1RDkU9BU

https://www.youtube.com/watch?v=k7Bf9p4-Kzo
https://www.youtube.com/watch?v=vnVMS_Dp0dU
https://www.youtube.com/watch?v=HkgsP0Jlc_o
https://www.youtube.com/watch?v=darVtuigUJA
https://www.youtube.com/watch?v=xzyR8Nsxloc
https://www.youtube.com/watch?v=plhLipR8yYQ

Text Books:

1. Gurdeep Raj. (2014). *Advanced Inorganic Chemistry*. 12th Edition. Geol Publishing House
2. Madan. R.D. (2011). *Advanced Inorganic Chemistry*. 3rd Edition. S. Chand & company, New Delhi.
3. Malik, U.K, Tuli, G.D & Madan, R.D (2010) *Selected Topics in Inorganic Chemistry*, S. Chand Publication.
4. Asim K. Das. (2015). *Bio-inorganic chemistry*. Books and Allied Pvt. Ltd.
5. Lehinger. ( ) *Bio-inorganic chemistry*.

Books for Reference:

1. Keith F. Purcell, John. C. Kotz. (1997). *Inorganic chemistry*, Holt- Saunders International Editions.
2. James E. Huheey. (1993). *Inorganic Chemistry*, Fourth edition, HarperCollins College Publishers. (Units I, II, III, IV)
3. Basolo, F. & Pearson. R.G. (1967) *Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution.* Wiley Eastern Limited.
4. Ivano Bertini, Harry B. Gray, Stephen J.Lippard, and Joan Selverstone Valentine. (1998). *Bioinorganic Chemistry*, VIVA books private Ltd. (Units III, IV).

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	H	H	S
CO2	S	S	H	H	S
CO3	S	S	H	H	S
CO4	S	S	H	H	S
CO5	S	S	H	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY415**	**Analytical Techniques**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	5	**Total Hrs: 65 Hrs**	**Credits:**	4

Course Objective

- To introduce the principles of error analysis to the students.
- To enable the students to attain knowledge on various chromatographic techniques and thermo analytical methods.
- To gain knowledge in ESR, Mossbauer spectroscopy and AAS, AES, Polarimetry and Photo Electron Spectrometry.

Course Outcomes (CO)

K1	CO1	Remember the various analytical methods.
K2	CO2	Comprehend the basic principle, instrumentation and applications of various chromatographic techniques, thermal analysis.
K3	CO3	Apply data analysis, various chromatographic techniques to separate the compounds, electron spin resonance and Mossbauer spectroscopy in the field of research.
K4	CO4	Evaluate the basic principle, instrumentation and applications of photoelectron spectroscopy, AAS, FES and Polarimetry.
K5	CO5	Interpret the data in chemical analysis.

Unit-1

Data Analysis **13 Hrs**

Defining terms: mean, median, accuracy and precision, improving accuracy of analysis - mean, standard deviation and Q-test, comparison of results - least square, t-test, f-test and chi square test, P-value, levels of confidence and significance, population and sample and reproducibility of measurements

Analysis of variance (ANOVA)- Correlation and Regression - curve fitting , fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals - general polynomial

equation fitting , linearizing transformations, exponential function fit - r and its abuse - multiple linear regression analysis, elementary aspects.

Self study: Errors and classification in chemical analysis

Unit-2

Chromatographic methods **13 Hrs**

Solvent extraction - Methods of extraction and applications of solvent extraction. Solid phase extraction - methods and applications - chromatography - HPLC - outline study of instrument modules. UPLC, UHPLC and HPLC-Mass spectroscopy, LCMS.

Gas chromatography - basic instrumental set up - carriers, columns, detectors and comparative study of TCD, FID, ECD and NPD.

Self study: Thin layer chromatography, ion exchange chromatography and size exclusion chromatography

Unit-3 **13 Hrs**

Thermal analysis

Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) and Thermometric titrations - basic principles, Instrumentation and application.Atomic absorption spectroscopy and Flame emission spectroscopy- Basic principles - Instrumentation and applications.

Photoelectron Spectroscopy

ESCA (XPS): principle, chemical shifts - description of ESCA spectrometer, X-ray sources, samples, analysis, detectors and recording devices, applications.

Self study: Auger electron spectroscopy (AES) and UV photo electron spectroscopy (UPS) - principles, applications and instrumentation

Unit-4 **13 Hrs**

Electron spin resonance

Theory - derivative curves -‘g’ values, Kramer’s degeneracy - zero field splitting - hyperfine splitting - isotropic and anisotropic systems - identification of free radicals (CH_3 and C_6H_5 radicals, Copper - Iron complex) - applications.

Mossbauer spectroscopy

Principle and theory- Doppler Effect, Isomer shift - quadruple interactions - magnetic interactions

Self study:Mossbauer spectroscopy - applications

Unit-5 **13 Hrs**

Polarimetry

Circular Dichroism and Optical rotatory dispersion -Basic principles of ORD and CD - Cotton effects - Octant rule - axial halo ketone rules - applications of ORD and CD.

Molecular fluorescence and phosphorescence

Principles and Applications of Fluorometers -Phosphorometers.

Self study: Fluorescence and phosphorescence–applications

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=OypCNBPmGBY
https://www.youtube.com/watch?v=a3F0OSOchlo
https://www.youtube.com/watch?v=XMtmSz_9umk
https://www.youtube.com/watch?v=ryo8Kd2Wgks
https://www.youtube.com/watch?v=5FczhvJrYNE
https://www.youtube.com/watch?v=DgA3-UnpSuI
https://www.youtube.com/watch?v=9zimhww51WI
https://www.youtube.com/watch?v=s7zsL9yFOsg
https://www.youtube.com/watch?v=a81cDH26f7A
https://www.youtube.com/watch?v=r55anTcoWvE
https://www.youtube.com/watch?v=X3AHbeZhKhU

Text Books:

1. Gurdeep R. Chatwal & Anand, S.K. (2003) *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House.
2. Sharma, B.K. (1999) *Instrumental methods of Chemical analysis*, 18th Edition. Goel Publishing house.
3. Ghosh, *Introduction to Photoelectron Spectroscopy*.

Books for Reference:

1. Skoog, D.A. West, D.M, Holder F.J & Grouch, S.R (2000) *Analytical chemistry an Introduction*, 6th Edition, Saunders College publishing.
2. Willard, H.H, Merrit L.L & Dean, J.A (2002). *Instrumental method of analysis*, 7th Edition, CBS Publishers & Distributors.
3. Drago, R.S (1964),*Physical methods in Inorganic chemistry*, 1st Edition, W. B. Saunders Company.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	H	S
CO2	S	S	S	H	S
CO3	S	S	S	H	S
CO4	S	S	S	H	S
CO5	S	S	S	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Ms. R.Mini Ms. K. Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY4E5**	***Major Elective -III Medicinal Chemistry**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	3	**Total Hrs: 39 Hrs**	**Credits:**	3

Course Objective

- The course is to enable students to understand drug actions.
- To learn chemistry of various types of drugs such as antibiotics, analgesics, antipyretics, cardiovascular, anti-tubercular drugs, antihistamines and antimalarial.

Course Outcomes (CO)

K1	CO1	Outline the physicochemical properties of drugs
K2	CO2	Describe drug absorption, distribution, metabolism and excretion
K3	CO3	Synthesize and study novel Antibiotics for future generations
K4	CO4	Formulate the synthesis of few important drugs such as analgesics, antipyretics, cardiovascular, anti-tubercular drugs, antihistamines and antimalarial
K5	CO5	Evaluate the application of Antibiotics, cardiovascular and anti-malarial drugs

Unit-1

Drug Discovery **07 Hrs**

Physiochemical properties in relation to biological action - influence of route of administration. Biotransformation-absorption from stomach -absorption from intestines –sites of loss - metabolism and excretion – oxidatental drug discovery, drug lead molecule, computer aided drug discovery, ADME Properties

Sulpha drugs -sulphathiazole, sulphamerazine, sulphaguanidine and other sulpha drugs,- synthesis, mechanism of action -uses.

Self study: harmful drugs and their side effects

Unit-2

Antibiotics **08 Hrs**

Antibiotics –Synthesis and uses - A study of Chloramphenicol, Penicillin - semisynthetic Penicillin –grossstructural features Streptomycin-Cephalasporin, Tetracycline – Antibiotic Resistance

Polyene antifungal antibiotics-nystatin, fusicidic acid-griesofulvin. (gross structuralfeatures not needed).

Self study: Antibiotics - Erithromycin, Chloromycetin

Unit-3

Analgesics and antipyretics **08 Hrs**

Study of morphine-structure activity relationship (SAR)-morphine analogues –Codeine-synthetic analgesics- pethidines and methadones -narcotic antagonist.

Antipyretic analgesics - salicylic acid, pyrazole and para amino phenol derivatives.

Self study: Sedatives -Barbiturates, Benzodiazepines

Unit-4

Cardio Vascular and anti-tubercular drugs **08 Hrs**

Cardio Vascular Drugs -classification, cardiac glysocides, anti-hypertensive andhypotensive agents -mode of action –anti-arythamic agents.

Anti-tubercular drugs -sulphanamides -sulphones, p-amino salicylic acid -INH.

Self study: Anti-tubercular drugs- ethambutal, Rifampicin.

Unit-5

Anti-histamines and anti-malarials **08 Hrs**

Anti-histamines-introduction -mode of action of anti-histamines - SAR –ethylene diamine, ethanol amine, propyl amine and –cyclizine derivatives –synthesis.

Self study: Anti-malarials-classification –quinine, 4-amino and 8-amino quinolines and pyrimidines

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Text Books:

1. Patric, G. L. (2005), *An Introduction to Medicinal Chemistry*. 3rded, Oxford University Press.

2. Silverman, R. B. (2004), *The Organic Chemistry of Drug Design and Drug Action*. 2nd Edition, Academic Press.

3. Williams, D. A., Lemke, T. L. (2006), Foye's, *Principles of Medicinal Chemistry*. 5th Edition. Wolters Kluwer Health (India) Pvt. Ltd.

ReferenceBooks:

1. Burger, A., (1990), Medicinal Chemistry, Vol – I and II, Wiley inter Science, New York.
2. Wilson, O., Giswold, O., George, F., (1991), *Text book of organic, Medicinal and Pharmaceutical Chemistry*, Lippincott Company, Philadelphia, 9th Edn.
3. Bentley and Driver, *Text book of Pharmaceutical Chemistry*.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	H	S	S
CO2	S	S	H	S	S
CO3	S	S	H	S	S
CO4	S	S	H	S	S
CO5	S	S	H	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name:Dr.K.Poonkodi Dr. V. Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY4E6**	***Major Elective - II Green and Nano Chemistry**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	3	**Total Hrs: 39 Hrs**	**Credits:**	3

Course Objective

- To stimulate students to have in-depth knowledge in green chemistry.
- To introduce the various type of greener reactions, materials.
- To understand the concept of Phase Transfer Catalysis.
- To acquire a clear idea about various synthesis of Nanomaterials and techniques.

Course Outcomes (CO)

K1	CO1	Recollect the hazardous effect of chemicals and solvents used in laboratory.
K2	CO2	Comprehend basic principles of green chemistry, importance of nanotechnology and fundamentals of nanotechnology.
K3	CO3	Apply the concept of green chemistry in synthesis.
K4	CO4	Review the preparation and experimental techniques of Nanomaterials.
K5	CO5	synthesize CNT and examine their properties in various fields

Unit-1 **07 Hrs**

Green Chemistry

Definition, basic principles, planning a green synthesis in the laboratory- atom efficiency process & atom economy- rearrangement, addition, substitution, elimination.
Synthesis involving basic principles of green chemistry – synthesis of styrene, adipic acid, green chemistry in day-today life - dry cleaning of clothes, versatile bleaching agents.

Self study: need for green chemistry

Unit-2 **08 Hrs**

Green reagents

Dimethylcarbamate, polymer supported reagents, green catalysts - acidic, basic, oxidation and polymer supported catalysts.

Microwave Induced Green Synthesis

Introduction- microwave assisted reactions in water – Hoffmann elimination, hydrolysis, oxidation, inorganic solvents- esterification, Diel's Alder reaction, decarboxylation and Fries rearrangement

Self study: chalcone synthesis

Unit-3 **08 Hrs**

Phase transfer catalysts

Introduction, definition, mechanism of phase transfer catalysed reaction, types and advantages of phase transfer catalysts, types of phase transfer catalysed reactions, preparation of phase transfer catalysts - alcohols from alkyl halides and addition to olefins.

Self study: applications of phase transfer catalysis in organic synthesis

Unit -IV

Nanomaterials **08 Hrs**

Bottom up and Top down approaches - methods of preparation of nano materials - plasma arching, chemical vapour deposition, electrodeposition, sol-gel synthesis.

Experimental Techniques

Instrumentation, principle and applications of scanning electron microscopy (SEM), transmission electron microscopy (TEM), atomic force microscopy (AFM), scanning tunnelling microscopy (STM) and ESCA

Self study: Introduction- definition – types, properties of nano materials

Unit-5 **08 Hrs**

Applications of Nanomaterials

Fullerenes -Introduction and properties, Carbon Nanotubes- types, properties, defects, synthesis and applications-structural materials, electromagnetic field, chemical field, electrical circuits and current applications.

Catalysis, environmental and biomedical (drug delivery) applications.

Self study: Nanomaterials-environmental hazards

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://m.youtube.com/watch?v=SvRe_wc0w3Q
https://m.youtube.com/watch?v=qNHchiUh-rs
https://www.youtube.com/watch?v=ebO38bbq04
https://www.youtube.com/watch?v=qUEbxTkPIWI

Text Books:

1. Ahluwalia, V.K. & Kidwai. M, *New Trends in Green Chemistry* (2004), Springer Science &Business media.
2. Ahluwalia. V.K, *Green Chemistry (Environmental benign Reactions)* (2006), Ane Books Pvt. Ltd.
3. Pradeep.T (2007), *Nano The Essentials*, McGraw Hill Education (India) Pvt.Ltd.
4. Pradeep.T (2012), *Text Book of Nano science and Nanotechnology*, McGraw Hill Education (India) Pvt.Ltd.

ReferenceBooks:

1. Ahluwalia. V.K, (2012), *Organic Synthesis - Special Techniques*, 2nd Edn, Narosa Publishing House.
2. Shanmugam. S, (2011), *Nanotechnology*, 1st Edition, MJP Publishers.
3. Richard Booker & Eary Boysen, (2008), *Nanotechnology*, 1st Edition, John Wiley
4. Poole C.P & Owns F.J. (2003), *Introduction to Nanotechnology* John Wiley & Sons.
5. Karkare. M. (2008). *Nanotechnology Fundamentals and Applications*. K. International Pvt. Ltd.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	H	H	H
CO2	S	S	H	H	H
CO3	S	S	H	H	H
CO4	S	S	H	H	H
CO5	S	S	H	H	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. R. Mini Ms. M.Anusuya	Name:Dr.K.Poonkodi	Name:Mr.K.Srinivasan	Name: Dr.R.Muthukumaran

Signature:	Signature:	Signature:	Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY416**	**Phytochemical techniques and health chemistry**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	**Self-study**		**Credits:**	2

Course Objective

- To enable post graduate students in Chemistry to gain knowledge on phyto chemical techniques.
- To enable them to be familiar with techniques of extraction, separation and purification and simple identification strategies of drugs/natural products.
- To acquaint with health and hygiene food system along carbohydrates and vitamins.
- To learn the mode of mechanism for common diseases.

Course Outcomes (CO)

K1	CO1	Understanding on necessity and role of carbohydrates and vitamins for humans.
K2	CO2	Remember the phytochemical techniques -extraction, separation and purification.
K3	CO3	Implement the basic values and analyze the functions of food, food pyramid and hygiene food system.
K4	CO4	Evaluate the mechanism for biological function of carbohydrates and vitamins
K5	CO5	Analyze the mechanism and causes of common diseases

Unit I- Extraction strategies of drugs/natural products

Extraction Techniques Cold and hot extraction methods, liquid-liquid extraction techniques, liquid-carbon dioxide extraction, concentration and evaporation techniques, lyophilisation, principles and technique of simple distillation -reduced pressure distillation- fractional distillation- steam distillation-rotary evaporation and centrifugation.

Unit II-Separation Techniques of drugs/natural products

Separation Techniques – Simple crystallization- experimental aspects – solvents for crystallization. Special methods– flavanoid, pigment extraction - GC-MS, LC-MS- identification of phytochemicals by NIST Library

Unit III- Purification Techniques of drugs/natural products

Purification Techniques – Preliminary methods of identification of extracts – Cermin chemical aspects-colour tests – TLC and fluorescent characteristics, proximate methods.Theory of melting and freezing – melting point and vapour pressure., Biological assays- antibacterial, antifungal, antioxidant and invitro anticancer activities.

Unit IV- Health

Definition: - Food, Food Pyramid, Health, Hygiene, mal under over nutrition, their causes and remedies, sanitation.

Carbohydrates: Classification, biological functions,Vitamins: Classification, biological functions.

Unit V-Common diseases

Toxicants in food cancer, types and causes, common diseases- jaundice, vomiting, fever, rickets, scurvy, beriberi, pellagra, gout, goiter, diabetes anemia, night blindness, ulcer, their causes.

Text Books

1. Harborne. J. B,(2008), *Phytochemical methods-A guide to modern techniques of Plant analysis*, 3rd edition,Springer publication.
2. Ahluwalia & Madhu Chopra. V.K, (2008), *Medicinal Chemistry*, Ane Books India.
3. Ashutosh kar, (2010), *Medicinal Chemistry*, 5th Edition, New Age international publishers.
4. Jayashree Ghosh, (1999), *A Textbook of Pharmaceutical Chemistry*, S. Chand and Co. Ltd.
5. Alex V Ramani, (2009),*Food Chemistry*, MJP Publishers, Chennai.
6. Satake M and Mido Y, (2003),*Chemistry for the Health Science*, Discovery Publishing House, New Delhi.

Reference Books

1. Graham L. Patrick, (2009),*An Introduction to Medicinal Chemistry*, 4th Indian Edition, Oxford publishers,
2. Krishnaswamy. N. R, (2010), *Chemistry of Natural Products*, 2nd Edition,An Unified Approach – Unified Press.
3. Krishnaswamy. N. R, (2003), *Chemistry of Natural Products A Laboratory Handbook*,1st Edition, University press India Pvt. Ltd.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	H	S	H	S
CO2	S	H	S	H	S
CO3	S	H	S	H	S

CO4	S	H	S	H	S
CO5	S	H	S	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY417**	**Inorganic Chemistry Practical –II**	**Batch :**	2020-2022
			Semester	III &IV
Hrs/Week:	4&5	**Total Hrs: 117Hrs**	**Credits:**	3

Course Objective

- To know and apply the principle of complexometric titration.
- To get an idea about the quantitative analysis of mixture of cations using volumetric and gravimetric principles.
- To allow the students to know and practice the techniques in preparation of some inorganic complexes.

Course Outcomes (CO)

K3	CO1	Recollect the preparation of coordination compounds.
K4	CO2	Understand the analysis of complexometric titration and mixture of cations using volumetric and gravimetric titration.
K4	CO3	Separate and estimate the metal ions in a mixture.
K5	CO4	Analyze the amount of individual cations present in a mixture using volumetric and gravimetric technique.
K5	CO5	Estimate the cations using complexometric titration and prepare coordination compounds by single stage preparation

A. Titrimetry:

Complexometric titration involving EDTA.

- Calcium
- Magnesium

- Nickel
- Zinc

B. Quantitative estimation:

Mixture of cations involving volumetric and gravimetric estimation

- Copper & Nickel
- Iron & Nickel
- Calcium & Copper
- Calcium &Barium.

ReferenceBooks:

1. Venkateswaran, V. Veeraswamy. R and. Kulandaivelu, A.R (1997) *Principles of Practical Chemistry* 2nd Edition Sultan Chand & Sons.
2. Giri. S, Bajpai. D.N and Panday O.P (1997). *Practical Chemistry* Vol. I & II, S.Chand & Co.
3. Bassart J. Dennay. R.C. Jeffery G.H. and Mendham (2004). *Vogel's text Book of qualitative Inorganic Analysis*, 4th Edn. The ELBS & Longman.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	S	S	H
CO2	S	S	S	S	H
CO3	S	S	S	S	H
CO4	S	S	S	S	H
CO5	S	S	S	S	H

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Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name:Ms.M. Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name:Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY418**	**Organic Chemistry Practical -II**	**Batch :**	2020-2022
			Semester	III &IV
Hrs/Week:	4&5	**Total Hrs: 117Hrs**	**Credits:**	3

Course Objective

- To attain knowledge in estimating organic compounds quantitatively.
- To learn and practice the methods of preparation of some organic compounds.
- To understand some chromatographic techniques.

Course Outcomes (CO)

K3	CO1	Remember aromatic substitution reactions and the basic principles of various chromatographic techniques.
K4	CO2	Understand the estimation of phenol, aniline, ketone and glucose and the extraction methods of natural product.
K5	CO3	Practice the preparation of organic compounds involving two stages, recrystallise and report.
K5	CO4	Estimate the amount of organic compounds present in the given solution
K5	CO5	Extract and estimate certain natural products and separate the compounds using chromatographic technique.

A. Quantitative estimations:

1.Estimation of phenol, aniline, ethyl methyl ketone, Glucose (iodimetry method and Bertrand's method).

2. Citric acid or ascorbic acid from a tablet or from a natural source

B. Two stage preparations:

1. Benzanilide from benzophenone

2. Acetyl salicylic acid from methyl salicylate

3. Preparation of m- nirtrobenzoic acid from methyl benzoate

4. Preparation of p- nitroaniline from acetanilide

5. Preparation of p-bromo acetanilide from aniline

C. Extraction: (Not for ESE examination**)**

1. Lactose from milk

2. Caffeine from tea

3. Curcumin from *Curcuma longa*

4. Nicotine from tobacco extract

5. Citric acid or ascorbic acid from a tablet or from a natural source.

D. Analysis of oil: (Not for ESE examination)

Reichart-Meisel value, saponification value and acetyl value.

E.Chromatography:

Column, Paper and thin layer.

Books for Reference:

1. Day. B.B and Sitaram M.V and Govindachari T.R (1999). *Laboratory Manual of Organic Chemistry*, Allied Publishers Limited.
2. Gnanprakasam and Ramamurthy (2000). *Organic Chemistry Laboratory Manual* Ananda Book Depot, Chennai.
3. Jagmohan (2004). *Advanced Practical Organic Chemistry* Vol. I & II.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	S	H	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name:Ms.K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY419**	**Physical Chemistry Practical -II**	**Batch :**	2020-2022
			Semester	III &IV
Hrs/Week:	4&5	**Total Hrs: 117 Hrs**	**Credits:**	4

Course Objective

- To arm the future chemist with the knowledge of electrical conductance measurement and conductometric titrations.
- To gain knowledge to make and record observations on conductometric titrations and chemical kinetics.

Course Outcomes (CO)

K3	CO1	Recollect the concept of conductometric titration, fundamentals of adsorption and the acid hydrolysis of ester.
K4	CO2	Understand various laws of electrochemistry and applications of electrical conductance measurements and the applications of chemical kinetics.
K5	CO3	Determine the cell constant and verify the Debye-Huckel Onsager equation and Kohlrausch's law.
K5	CO4	Determine the relative strength of acids and rate of reaction.
K5	CO5	Estimate the amount of ions condutometrically and evaluate the amount of oxalic acid adsorbed using charcoal as adsorbent.

Electrical Conductance measurements

1. Determination of cell constant
2. Verification of Debye-Huckel Onsager equation
3. Ostwald's dilution law
4. Verification of Kohlrausch's law
5. Solubility Product of sparingly soluble salt

Conductometric Titrations: Acid-Base titrations

6. Strong Base Vs Weak Acid
7. Strong Base Vs Mixture of (weak and strong) Acids

Precipitation titrations

8. $AgNO_3$ Vs mixture of halides (KCl & KI)
9. $BaCl_2$ Vs $MgSO_4$
10. Buffer Vs Strong acid

Chemical Kinetics

11. Acid hydrolysis of an ester - Relative strength of acids
12. Reaction kinetics of KI and $K_2S_2O_8$
13. Iodination of acetone

Adsorption

14. Adsorption of oxalic acid on charcoal

Books for Reference:

1. Palit S.R. and De S.K (2003). *Practical Physical Chemistry*, Science Book Agency, Calcutta.
2. Sharma P.C. and Agarwal (1998). *Practical Chemistry*,
3. Goel Publishing House, Meerut.
4. Venkateswaran and Kulaindaivelu (2005). *Practical Physical Chemistry* S. Chand & Co.

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	H	S	S	S	H
CO2	H	S	S	S	H
CO3	H	S	S	S	H
CO4	H	S	S	S	H
CO5	H	S	S	S	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name:Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
			Batch	2020-2022
Course Code:	**20PCY420**	**Project Work & Viva-Voce**	**Semester**	IV
Hrs/Week:	2	**Total Hrs: 26Hrs**	**Credits:**	7

Course Objective

- Make the students to understand the importance of experimental analysis, scientific approach in solving problems related to the environment and society.
- Educate and train the students to write scientific papers.

Course Outcomes (CO)

K3	CO1	Apply the various preliminary skills in laboratory
K4	CO2	Analyze the various sources of literature review
K5	CO3	Evaluate the various techniques from the previous studies
K5	CO4	Apply the suitable parameters in the project work.

Individual Project and Viva Voce

- Each faculty will be allotted 4/5 students.
- The topic/area of work will be finalized at the end of III semester, allowing scope for the students to gather relevant literature during the vacation.
- The research work can be carried out in the college or at any other organization approved by the College.
- Viva Voce/Power point presentation will be conducted by a panel comprising of HOD, internal / external examiners.

Research Areas

Synthetic Organic Chemistry, Coordination Chemistry, Phytochemistry, Surface Chemistryand Nanochemistry, etc.,

Methodology

Each project should contain Introduction, Review of Literature, Materials and Methods**,**Results and Discussions – evidences in the form of figures, tables and photographs,Summary and Bibliography

Evaluation - Total - 100 Marks (Internal – 20 marks, External – 80 marks)

Internal **Total - 20 marks**

I Review – Selection of the field of study, Topic & Literature collection
II Review – Research Design and Data Collection
III Review – Analysis & Conclusion, Preparation of rough draft

- 20 marks

Paper Presentation in National / International Conference
(Or)
Paper Publication in UGC Care list Journals

External **Total – 80 marks**

Project	**Total – 60 marks**
Relevance of the topic to the academic / society	10 Marks
Objectives	10 Marks
Experimental design	20 Marks
Expression of results and discussion	20 Marks
Viva Voce	**Total – 20 marks**
Presentation	10 Marks
Discussion	10 Marks

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	S	S	H
CO2	S	S	S	S	S
CO3	S	S	S	H	H
CO4	S	S	S	S	S
CO5	S	S	S	H	H

S-Strong; H-High; M-Medium; L-Low

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Name and Signature	Name and Signature	CDC	COE
Name:Dr.K.Poonkodi Dr.V.Prabhu Ms.K.Vimaladevi Ms. R.Mini Ms. M.Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name:Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

VALUE ADDED COURSE SCHEME

SEM	Course Code	Title of the Paper	Total hours	Examination				Credits
				Hours	CIA	ESE	Total	
I	19PCV401	Cosmetics chemistry	30	2			50	Grade
I	19PCV402	Treatment of industrial waste water	30	2			50	Grade

19 PCV401-COSMETICS CHEMISTRY

Scope

- The students will be familiar with the physical and chemical properties and reactions of commonly used raw materials in cosmetics.
- Students will be familiar with chemistry (especially the reactivity and stability of an organic molecules based on structure and isomerism) of commonly used chemicals.
- They will know common natural raw materials in cosmetics, especially the basic functional group involved, their properties and applications.

Objectives

This course is designed to provide foundation knowledge of cosmetic principles to address the needs of cosmetic industry.

Provide practical skills in the area of biology, formulation science,cosmeceuticals (cosmetics with¬ skin, hair and oral care benefits) and personal care and hygiene products.

Provide knowledge on cosmetics, and related sciences,

Provide with knowledge on marketing approaches on studying consumer need, need gaps,¬ managing competition and global markets.

Employability

- To provide worldwide opportunity to study cosmetic science
- Students have the opportunity to undertake an optional placement and enhance their entrepreneur skill by offering valuable experience.

Nature of Course

Value added certificate course

Advantages

Students will be familiar with the different exposure of chemicals used in the cosmetics and one can design and practice ecofriendly cosmetics of their own.

Course Outcomes

- The student will acquire basic information about the possibilities and limitations of cosmetic products, their importance and marketing.
- To know the prohibited, regulated and authorized ingredients for cosmetic products, their origin, chemical nature and importance.
- To familiar with the principles of production as well as composition of cosmetics and products.

UNIT-I **L P T**

20 10 30 hrs

Cosmetics- Classification, significance, quality control and its importance, stability of product forms and its significance.Physical and chemical properties of agents and designing of different product forms. Review of current product forms in market.

UNIT-II

Basic raw materials, preparation and uses of Hair dye, Shampoo, Lipsticks, Handmade herbal Soap, Herbal tooth powder, Phenyl making, liquid soap and detergents.

UNIT-III

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, Civetone and Muscone. Surfactants- Introduction, physical and chemical properties, its types, HLB scale and its application in cosmetics. Review of commercialized surfactants.

Text Books:

1.Gaurav Kumar Sharma, Jayesh Gadiya and Meenakshi Dhanawat, (2018),Textbook *of Cosmetic Formulations*,.

2.Perry Romanowski Randy Schueller,(1973), Beginning Cosmetic Chemistry, 3rd Edition

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Reference Books:

1. E. Stocchi: *Industrial Chemistry*, Vol -I, Ellis Horwood Ltd. UK. •

2. P.C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.

3. B.K. Sharma: *Industrial Chemistry*, Goel Publishing House, Meerut.

4. D.F. Williams,*Chemistry and Technology of the Cosmetics and Toiletries Industries* Springer International Edition.

5. Robert D. Hisrion and Michael P. Peters, *Entrepreneurship* 5th Edition.

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19PCV-402- ASSESMENT, CHARACTERIZATION AND TREATMENT OF INDUSTRIAL WASTE WATER

Scope

- This course will train participants with the knowledge, skills and competencies required for success in the practical operation of water treatment plants.
- This course is designed to expertise regulations governing industrial wastes, sources of wastes, methods for preventing and minimizing wastes at the source, and industrial waste monitoring.

Objectives

Upon completion, the participant should be able to:

- Define and implement cleaner production activities, industrial water management strategies for pollution and toxicity prevention.
- To Select the most appropriate treatment technology and design a wastewater treatment methods to treat an industrial effluent stream for a selected industry.
- Integrate cleaner production, industrial water management, wastewater treatment processes, and disposal in the design on an industrial waste treatment process for a selected industry.

Employability

- Graduates will be qualified to work in Wastewater Treatment Plants as operators to the expected industry standard.
- Students have the opportunity to undertake an optional placement and enhance their entrepreneur skill by offering valuable experience.

Nature of Course

- Value added

Advantages

- To reduce, recycle and reuse water for different purposes

Course Outcomes

- To teach the students the essential role of water in industries
- To study the various methods involved in analytical techniques
- The pupil will learn about the characteristics of water, water pollution and how to manage and prevent water pollution.
- Learn the physico chemical properties of water, different wastewater treatment processes and water management strategies.

	L	P	T
UNIT-I	20	10	30 hrs

Characteristics of Water **10 Hrs**

Introduction – sources of water – Characteristics of water, Water Analysis- study of water samples - acidity, alkalinity, Hardness, free chlorine, chlorine demand, calcium, magnesium, iron, manganese, zinc, ammonia, nitrate, sulphate and fluoride, DOC, BOD, CODand their importance-

Disadvantages of hard water – Scale and sludge formation in boiler – Boiler Corrosion - Softening methods –desalination of Brackish water: Distillation, Electro dialysis and reverse osmosis.

UNIT-II

Water Pollution **10 Hrs**

Introduction –water Pollutants – physical and chemical pollution of water – ground water pollution – harmful effects of ground water pollution – surface water. River water and sea water pollution, Oil pollution of water. Effects oil pollution in marine water – Radioactive materials in water- Role of pollution control boards.

UNIT-III

Physico chemical Examination of water **10 Hrs**

Collection of samples – colour – odour Turbidity pH – temperature – Soilds: Total Solids, Dissolved solids, suspended solids, settable solids – Acidity — Alkalinity – Hardness – calcium, Magnesium, Sodium - Potassium - Iron–*Dissolved Oxygen, BOD, COD,* biological and chemical treatments.

Text books:

1.Mark C. M. van Loosdrecht, Per Halkjaer Nielsen, C. M. Lopez-Vazquez, Damir Brdjanovic, (2016). Experimental methods in waste water treatment**,** IWA Publishing.

Vivek V. Ranade, Vinay M. (2014).Industrial Wastewater Treatment, Recycling and Reuse. Bhandari Butterworth-Heinemann Publications,

Reference Books:

1. Mukhlyonov. I(1979) *Chemical Technology*, Moscow, 3rd Edition. Mir publication
2. Norris Shreve. R &. Brink, J.A (1977) *Chemical Process Industries.*4th Edition. McGraw Hill Tokyo.
3. Agarwal. S.K. (2005) *Water Pollution,* APH Publishing.
4. Chakrabarty, B.N. (1981) *Industrial Chemistry*, Oxford & IBH Publishing Co., New Delhi.
5. Singh, P.P. Joseph, T.M. Dhavale, R.G (1983) *College Industrial Chemistry*, Himalaya Publishing House, Bombay, 4th Edition
6. De. A.K. (1989) *Environmental Chemistry*, 11th Edition, Wiley Eastern Ltd. Meerut.

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