PG DEPARTMENT OF CHEMISTRY

SYLLABUS

2017-2019 BATCH

FACULTY MEMBERS

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

Dr. S. SOUNDARAYA, M.Sc., Ph.D.

Ms. K. VIMALADEVI, M.Sc.,M.Phil.,

Ms. R. MINI, M.Sc.,M.Phil.,

Ms. M.RUBINI, M.Sc.,

NGM COLLEGE (Autonomous)
Affiliated to Bharathiar University

Re-Accredited with 'A' grade by NAAC & ISO 9001:2008 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

I SEMESTER								
Part	**Course Code**	**Title of the Paper**	**Duration in hours per week**	**Examination**				**Credits**
				Hours	**CIA**	**ESE**	**Total**	
III	17PCY101	Inorganic Chemistry -I	5	3	25	75	100	5
III	17PCY102	Organic Chemistry -I	5	3	25	75	100	5
III	17PCY103	Physical Chemistry -I	5	3	25	75	100	5
III	17PCY207	Inorganic Chemistry Practical-I	5	6	--	--	--	--
III	17PCY208	Organic Chemistry Practical-I	5	6	--	--	--	--
III	17PCY209	Physical Chemistry Practical -I	5	6	--	--	--	--
							300	15
II SEMESTER								
Part	**Course Code**	**Title of the Paper**	**Duration in hours per week**	**Examination**				**Credits**
				Hours	**CIA**	**ESE**	**Total**	
III	17PCY204	Inorganic Chemistry-II	5	3	25	75	100	5
III	17PCY205	Organic Chemistry-II	5	3	25	75	100	5
III	17PCY206	Physical Chemistry-II	5	3	25	75	100	5
IV	17PCY2N1/ 17PCY2N2	Non-Major Elective: Chemistry in day today life / Chemistry in context	1	3	--	100	100	2
III	17PCY207	Inorganic Chemistry Practical - I	5	6	40	60	100	3
III	17PCY208	Organic Chemistry Practical -I	5	6	40	60	100	3
III	17PCY209	Physical Chemistry Practical -I	4	6	40	60	100	4
							700	27

III SEMESTER								
Part	**Course Code**	**Title of the Paper**	**Duration in hours per week**	**Examination**				**Credits**
				Hours	**CIA**	**ESE**	**Total**	
III	17PCY310	Organic Chemistry -III	5	3	25	75	100	5
III	17PCY3E1	Major Elective-I-Spectroscopy	5	3	25	75	100	5
III	17PCY311	Physical Chemistry - III	5	3	25	75	100	5
III	17PCY3E2	Major Elective –II-Green, Nanochemistry and Cyber Security	3	3	25	75	100	3
III	17PCY414	Inorganic Chemistry Practical -II	3	6	--	--	--	--
III	17PCY415	Organic Chemistry Practical -II	3	6	--	--	--	--
III	17PCY416	Physical Chemistry Practical -II	4	6	--	--	--	--
IV	17PCY417	Project Work	2	6	--	--	--	--
							400	18

IV SEMESTER								
Part	**Course Code**	**Title of the Paper**	**Duration in hours per week**	**Examination**				**Credits**
				Hours	**CIA**	**ESE**	**Total**	
III	17PCY412	Inorganic Chemistry -III	5	3	25	75	100	4
III	17PCY4E3	Major Elective-III – Applied electrochemistry	5	3	25	75	100	3
III	17PCY413	Physical methods in chemistry	5	3	25	75	100	5
III	17PCY414	Inorganic Chemistry Practical -II	4	6	40	60	100	3
III	17PCY415	Organic Chemistry Practical -II	4	6	40	60	100	3
III	17PCY416	Physical Chemistry Practical -II	4	6	40	60	100	4
IV	17PCY417	Project Work & viva voce	3	6	40	160	200	8
							800	30
TOTAL MARKS							**2200**	**90**

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	A(Answer all)	10x1=10	MCQ/Define	75
K2	B (Either or pattern)	5x5=25	Short Answers	
K3& K4	C(Answer 4 out of 6)	4x10=40	Descriptive/ Detailed	

2. Theory: 100 Marks

Knowledge Level	Section	Marks	Description	Total
K3	A(Answer 5 out of 8)	5x5=25	Short Answers	100
K4	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	100
K4		40	
K5			

4. Project:

Knowledge Level	Section	Marks	Total
K3	Literature Review & Presentation	40	200
K4		160	
K5	Project report present & viva		

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:	**17PCY101**	**Inorganic Chemistry -I**	**Batch :**	2017-2019
			Semester	I
Hrs/Week:	5		**Credits:**	5

Course Objective

- To have knowledge about the principles of solid state chemistry, acid base concepts and nontransition elements.
- 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, nuclear chemistry and non-transition elements
K2	CO2	To understand the electrical properties of solid state, to comprehend different concepts of acids and bases, To deduce the preparation and properties of P-block elements and to 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

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, ilmeniteand spinels.

Metallic state - *free electron theory* and band theory - non - stochiometry - point defects in solids - schottky and frenkel defects - linear defects - dislocations - effects due to dislocations. Electrical properties of solids - insulators - intrinsic semiconductors - impurity semiconductors (n and P type) - super conductivity - 1,2,3 super conductor - BCS (cooper pair) theory - meissner effect.

Unit-2

Modern concepts of Acids and bases

Arrehenius concept - Bronsted-Lowry concept - levelling solvents - lux-flood concepts - sovent system concept - Cadey-Elsey concept - Lewis concept - Usanovich concept - relative strength of acids and bases, HSAB principle - Pearson concept - limitaions and applications - basics for hard-hard and soft-soft interactions.

Non aqueous solvents - classification of solvents, characteristic properties of ionizing solvents - liquid ammonia, liquid HF, liquid N_2O_4, liquid SO_2 and molten salts as non aqueous solvents.

Unit-3

Chemistry of Non-transition Elements

General discussion on the properties of the nontransition elements- special features of individual elements - synthesis, properties and structure of their halides and oxides - polymorphyism of carbon, phosphorus and sulphur. Synthesis, properties and structure of silicates carbides and silicones.

Peroxo compounds of boron, carbon and sulphur oxy acids of nitrogen, phosphorous, sulphur and halogens, interhalogens pseudohalides and noble gas compounds

Unit-4

Chains - catenation, heterocatenation, isopolyanions, heteropolyanions.

Cages - phosphorous compounds, boranes, carboranes, metallocene carboranes.

Metal clusters - dinuclear, trinuclear, tetra nuclear and hexa nuclear clusters - polyatomic zintl anions and cations - chevral phases - fullerenes and similar compounds.

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

Unit-5

Nuclear Chemistry

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. Radioactive decay and equilibrium-nuclear reactions-Q value, cross sections, types of reactions, chemical effects of nuclear transformations - *fission and fusion, fission products and fission yields.*

Radioactivetechniques- tracer technique, neutron activation analysis, Particle acceleration.

Counting techniques-linear accelerator - cyclotron and synchrotron - betatron - G. M. counter - proportional and scintillation counters.

**Italicized* texts are for self study

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

Power Point Presentation: Solid state

Seminar: Concepts of acids and bases, Non-aqueous solvents

Assignment : phosphonitrilic compounds

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. 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.
4. H.J.Arwnikar. (1989). *Nuclear chemistry*, Wiley Eastern limited, New Delhi.
5. Samuel Glasstone. (2014) Source book of Atomic energy, Krieger Publishing Company, 3rd Revised edition edition
6. A R West. (2013). *Solid State Chemistry and its applications*, 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	L	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: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY102**	**Organic Chemistry -I**	**Batch :**	2017-2019
			Semester	I
Hrs/Week:	5		**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.
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

Aromatic character – three, four, five, six, seven and eight membered rings - other systems with aromatic sextets - *Huckel's theory of aromaticity*, concept of homoaromaticity and antiaromaticity, alternant and non-alternant hydrocarbons (azulene type). hetero aromatic molecules- Annulenes, ferrocene, sydnones and fullerenes (synthesis not necessary).

Kinetic and Non-kinetic Methods of Determination of Reaction Mechanisms

Kinetic and thermodynamic control of chemical reactions – Hammond postulate – microscopic reversibility- methods of determining intermediates- Difference between intermediate and transition state, cross over experiments, isotope labeling, stereochemical evidence, Primary and secondary kinetic isotopic effects and rate law.

Linear free energy relationship (Hammet equation) - significance of substitution and reaction constant - limitations and deviations - Taft equation.

Unit-2

Electrophilic substitution reactions

Aromatic electrophilic substitution reactions - Arenium ion mechanism - orientation and reactivity in mono substituted benzene rings - - ortho/para ratio - *ipso* attack, orientation in disubstituted benzene rings. Typical reactions - Friedel Crafts alkylation & acylation, Reimer-Tiemann, Vilsmeier-Haack reaction, Hofmann-Martius and Jacobsons reaction, Pechmann and Houben-Hoesch reaction, Gattermann, Gattermann-Koch reaction, Diazonium coupling, Kolbe Schmidt reaction.

Aliphatic electrophilic substitution reactions – SE1, SE2 and SEi mechanism. Typical reactions – Migration of Double bond, Keto – enol Tautomerisum, halogenation of carbonyl compounds - Stork enamine reactions - decarboxylation of aliphatic acids - Friedel Crafts acylation of olefinic carbon.

Unit-3

Nucleophilic substitution reactions and mechanisms

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 ($A_{Ac}2$, $A_{Ac}1$, $B_{Ac}2$, $B_{Al}1$ 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 - diazonium group as leaving group.

Unit-4

Elimination reactions

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

Unit-5

Reactive Intermediates

Classical and non-classical carbocations – carbanions - carbenes and nitrenes - generation and stability of reactive intermediates -correlation of reactivity with structure of reactive intermediates.

Free radicals - configurations - identification by chemical and spectral methods - free radical halogenation. 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, 1,3 dipolar addition.

**Italicized* texts are for self study

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

Assignment : Fullerenes and naming reactions
Power point presentation : Hammet and Taft equation
Seminar : Addition reactions

Books for Study:

1. Jerry March (2007) *Advanced organic chemistry*. 4th Edition, A Wiley-Interscience.
2. S.M.Mukherjee and S.P.Singh (2004), *Reaction Mechanism in Organic Chemistry*. 10th Edition, Macmillan India Ltd.
3. Agarwal, O.P. (2014). *Reactions and Reagents in Organic Chemistry*. 49th Edition. Goel publishing house.
4. Ahluwalia, V.K. Rakesh K. Parashar (2010). *Organic Reaction Mechanisms*. 4th Edition. Narosa Publsihing House.
5. Tewari, KS, Vishnoi (2006). NK A *Text book of Organic Chemistry*. 3rd Edition. Vikas Publication., H.J. (2000). *Essentials of Nuclear Chemistry*. 4th Edition. New Age International

Books for Reference:

1. Depuy, C.H. & Chapman. O.S. (1972) *Molecular reactions and photochemistry*. Prentice Hall.
2. Finar, I.L. (2002) *Organic Chemistry. Vol.1*. 5th Edition. Pearson India Ltd.
3. Morrison, R.T, Boyd, R.N (2013) *Organic Chemistry*.7th Edition. Pearson India Ltd.
4. Jagadambal and Singh (2014) *Advanced Organic Chemistry.* 20thEdition. Pragati prakasham publishers.

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.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY103**	**Physical Chemistry -I**	**Batch :**	2017-2019
			Semester	I
Hrs/Week:	5		**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 orbitals.
K4	CO4	To estimate the molecular weight and stereochemistry of macromolecules.

Unit-1

Group theory-I:

Symmetry elements and symmetry operations - identity element - reflections symmetry planes- inversion center, 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 - postulates of group theory - group multiplication table - orthogonality and irreducible representations - application of the orthogonality theorem to obtain the irreducible representations of the point groups C2v, C3v , C2h and C3h.

Unit-2

Group theory-II:

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 - *mutual exclusion principle* - classification of vibrational modes - application of group theory to bonding: hybridization scheme for orbital, 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:

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 and Hinselwood Theory of unimolecular reactions - Marcus theory of electron transfer Process.

Kinetics in liquid solution - collision in 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:

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

Macromolecules:

Addition and condensation polymers, determination of molecular weights - number average, weight average, sedimentation and viscosity average molecular weights of macromolecules. Kinetics of polymerization - molecular and free radical mechanism. *Techniques of Polymerisation: bulk, emulsion, solution and suspension.*

Stereochemistry of polymers, Electronically conducting polymers-$(SN)_x$ – poly aniline, poly acetylene and poly para phenylene.

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, Case study

Assignment : Application of group theory to bonding: hybridization scheme for orbital, AB_4 (T_d, CH_4), AB_5 (D_{3h} $Fe(CO)_5$) and AB_6 (O_h $[Co(NH_3)_6]^{3+}$).

Power point presentation : Application of the orthogonality theorem to obtain the irreducible representations of the point groups C2v, C3v , C2h and C3h.

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. Kalidas. C. (2005) *Chemical Kinetic Methods: Principles of Fast Reaction Techniques And Applications*, New Age International.
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

Books for Reference:

1. Jeffery, J. Bassett, G.H, Mendham, J & Denney, R.C (1989).
2. Cotton, F.A. (1990) *Chemical applications of group theory,* 3rd Edition, A Wiley Interscience Publication.
3. 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.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY204**	**Inorganic Chemistry –II**	**Batch :**	2017-2019
			Semester	II
Hrs/Week:	5		**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 and magnetic behaviour.
- 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

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

Quantum number of multi electron atoms- R-S coupling, L-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, d^1 and 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 (for d^1, d^2 and d^4 systems) - 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

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 - mixed valent complexes - complementary and non complementary reactions.

Unit-4

Organometallic Chemistry – I

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 - dinitrogen complexes - dioxygen complexes.

Unit-5

Organometallic Chemistry – I

Synthesis, reactions, bonding and structure in metal alkyl, alkene, alkyne, allyl and dienyls complexes - carbocyclic pi compounds.

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, Case study

Assignment : CFSE & MOT

Power point presentation : Orgel diagram and TB diagrams

Seminar : mechanism of redox reaction

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. Gopalan .R , Ramalingam .V, (2001) Concise Coordination Chemistry, 3rd edition, Vikas Publishing house pvt Ltd

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: M.Rubini Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY205**	**Organic Chemistry –II**	**Batch :**	2017-2019
			Semester	II
Hrs/Week:	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:

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:

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 - ene reaction - photo substitution reactions of benzene derivatives - photolysis of nitrile esters.

Unit-3

Pericyclic reactions:

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 (4n), (4n+ 2), allyl systems.

Cycloadditions reactions - correlation diagram and FMO approach, $\pi 2s + \pi 2s$, $\pi 2s + \pi 4s$ (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:

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

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

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

Unit-5

Alkaloids:

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, 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.

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.
5. Finar, I.L. (2002) *Organic Chemistry. Vol.1.* 5th Edition. Pearson India Ltd.

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.S.soundarya Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY206**	**Physical Chemistry –II**	**Batch :**	2017-2019
			Semester	II
Hrs/Week:	5		**Credits:**	5

Course Objective

- To motivate the students to comprehend a knowledge on quantum mechanics
- To learn the concepts of electro chemistry and Surface chemistry.

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 electrokinetic phenomena and to understand the theories of surface chemistry
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 surface chemistry.

Unit-1

Quantum Chemistry-I:

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) - 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:

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 - electron spin and Pauli's principle.

Approximation Methods: Approximate methods in quantum mechanics - need for the approximation methods - perturbation and variation methods applicable to H_2 molecule in the ground and excited states - He atom in the ground state, He^{2+} in the ground and excited state.

Unit-3

Quantum Chemistry-III:

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 - directional character - determination of bond angles.

Unit-4

Electrochemistry:

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

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

Unit-5

Surface chemistry

Catalysis- characteristics - acid-base catalysis - enzyme catalysis - Michaelis-Menten equation - effect of temperature on enzyme catalysis - heterogeneous 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, Case study

Assignment : Kinetics of heterogeneous catalysis

Power point presentation : Quantum Chemistry-II

Seminar : Electrochemistry

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. 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: R.Mini Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY2N1**	**Non Major Elective-I CHEMISTRY IN DAY TO DAY LIFE**	**Batch :**	2017-2019
			Semester	II
Hrs/Week:	1		**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 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 water analysis. 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 water analysis technique to study water samples.
K4	CO4	To analyze BOD, COD, DOC, acidity, alkalinity of water

Unit-1

Water Analysis- study of water samples - acidity, alkalinity, free chlorine, chlorine demand, calcium, magnesium, iron, manganese, zinc, ammonia, nitrate, sulphate and fluoride, DOC, BOD, COD.

Unit-2

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

Unit-3

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

Unit-4

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

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

Unit-5

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, 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.

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

3. 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.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY2N2**	**Non Major Elective-II CHEMISTRY IN CONTEXT**	**Batch :**	2017-2019
			Semester	II
Hrs/Week:	1		**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.

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

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 - chloroflurocarbons and their interactions with ozone - the antartic ozone hole.

Unit-2

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

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

Unit-4

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

The world of plastics and polymers - 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, 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: K.Vimaladevi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY310**	**Organic Chemistry –III**	**Batch :**	2017-2019
			Semester	III
Hrs/Week:	5		**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.

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 alkaloids 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 and reagents involved in organic synthesis.

Unit-1

Terpenoids: 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, squalene.

Unit-2

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

Unit-3

Proteins and Polypeptides: Primary, secondary and tertiary structures of proteins - the N- terminal and C- terminal residue analysis, synthesis of polypeptides, *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.

Antibiotics: Structure and synthesis of penicillin and *streptomycin, Erithromycin, Tetracycline and Chloromycetin.*

Unit-4

Condensation reactions: 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.

Unit-5

Reagents in organic synthesis: 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, 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.

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.
3. Barry Victor Charlwood &Banthorpe, D. V. (1991) *Terpenoid*, Academic press publishers**.**

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. S.Soundarya Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY3E1**	**Major elective-I Spectroscopy**	**Batch :**	2017-2019
			Semester	III
Hrs/Week:	5		**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.

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

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 absorbtions of organic molecules- finger print region -identification of functional groups - applications to organic and inorganic compounds -medical diagnosis (cancer)- instrumentation- FT- IR.

Raman spectra - rotational raman spectra of linear and symmetric top molecules - vibrational raman spectra, rotational fine structure.

Unit-2

UV and visible spectroscopy:

Electronic spectra of diatomic molecules - *laws of photometry* - electronic absorption transitions - correlation of electronic structure with molecular structure - simple chromophoric groups - effects of conjugation - woodward - fieser rules -aromatic system and systems with extended conjugation - applications to organic and inorganic compounds - instrumentation.

Unit-3

Nuclear Magnetic ResonanceSpectroscopy -^{1}HNMR:

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 and inorganic compounds- instrumentation -CW and FT NMR

Unit-4

^{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, Protondetected HETCOR: HMQC, HMBC, NOESY.

Unit-5

Mass Spectrometry

Theory - *instrumentation* - isotopic abundance - determination ofmolecular weights and formula, ionisation techniques (CI, FD, FAB &ESI) - nitrogen rule -metastable ions and peaks - ion fragmentation mechanisms - Retro Diels-Alder rearrangement -Mclafferty rearrangement - fragmentation associated with functional groups - aliphatic and Aromatic compounds - 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.

**Italicized* texts are for self study

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

Assignment : Instrumentation of mass spectroscopy

Power point presentation : IR and NMR

Quiz : Problem interpretation using spectroscopic data

Books for Study:

1. Banwell. C.N. (1994), *Fundamentals of molecular spectroscopy*,3rd Edition, Tata McGraw Hill Publishing Company Ltd.
2. Kemp, W. (1991), *Organic Spectroscopy*, 3rd Edition, Mc Millan Press Ltd.
3. Silverstien, Bassler and Morril, (2014), *Spectrometric identification of organic compounds*, 8th Edition, John Wiley and Sons, INC.
4. Sharma, Y.R. (2005), *Elementary Organic Spectroscopy*, 3rd Edition, S. Chand & Company Ltd.

Books for Reference:

1. Dyer, J. (1965), *Application of absorption spectroscopy of organic compounds*, Prentice and Hall of India Pvt., New Delhi.
2. Jagmohan, (2005) ,*Organic Spectroscopy Principles and Applications*, 2nd Edition , Narosa publishing house.

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 Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY311**	**Physical Chemistry –III**	**Batch :**	2017-2019
			Semester	III
Hrs/Week:	5		**Credits:**	5

Course Objective

- To enable a comprehensive knowledge on Thermodynamics and non -ideal systems.
- To understand quantum statistics, Partition function and fundamentals of Photo chemistry.

Course Outcomes (CO)

K1	CO1	To remember the fundamentals of thermodynamics and photochemistry.
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:

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:

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. Distribution laws. Gaussian distribution.

Unit-3

Quantum statistics:

Introduction- types - maxwell - boltzmann statistics. Thermodynamic probability. Thermodynamic probabilities of systems in equilibrium. Boltzmann expression for entropy. Stirling's approximation. States of maximum thermodynamics probability. Legrangian multipliers, thermodynamic probabilities of systems involving energy levels. Maxwell - Boltzmann distribution law. Evaluation of alpha and beta in M.B. distribution law.

Unit-4

Partition function:

Partition function - definition, types, canonical ensembles. Molecular partition function and canonical function. 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

Fundamentals of Photochemistry:

Physical properties of the electronically excited molecules -excited state dipole moment-excited state acidity constants- pK* values- geometry of some electronically excited molecules- types of photophysical pathways.

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

**Italicized* texts are for self study

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

Assignment : Third law of thermodynamics

Group discussion **:** Photochemistry

Books for Study:

1. Puri B.R & Sharma. L R (2009, *Advanced Physical Chemistry*, 2nd Edition., Milestone Publishers & Distributors.
2. Gupta, M.C. (1990), *Statistical thermodynamics,* Wiley Eastern Limited.
3. Rajaram Kuriacose (2006), *Statistical thermodynamics*, 4th edition, Shoban lal & Co.
4. Bajpai, D.N. (1992, *Advanced Physical Chemistry,* S. Chand Publishing Limited.
5. Rohatgi, Mukherjee. K.K. (1992), *Fundamentals of Photochemistry,* Wiley Eastern limited.

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.

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.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY3E2**	**Major Elective - II GREEN, NANO CHEMISTRY AND CYBER SECURITY**	**Batch :**	2017-2019
			Semester	III
Hrs/Week:	3		**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:

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:

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

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.

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:

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

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

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

**Italicized* texts are for self study

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Experience Discussion, Brain storming, Activity, 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. Karkare. M, *Nanotechnology Fundamentals and Applications* (2008), K. International Pvt. Ltd.
4. Kothari. C.R, *Research Methodology* (2004) New Age International (P) Limited.
5. Ahluwalia, V.K. & Kidwai. M, *New Trends in Green Chemistry* (2004), Springer Science &Business media.
6. Ahluwalia. V.K, *Green Chemistry (Environmental benign Reactions)* (2006), Ane Books Pvt. Ltd.
7. WM. Arthur Conklin, Greg White, TMH "Principles of Computer Security"

Books for Reference:

1. Poole C.P & Owns F.J. (2003), *Introduction toNanotechnology* 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.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	L	L	L
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S-Strong; H-High; M-Medium; L-Low

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Name: M.Rubini Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY412**	**Inorganic Chemistry - III**	**Batch :**	2017-2019
			Semester	IV
Hrs/Week:	5		**Credits:**	5

Course Objective

- To allow the students to get introduced to the study of Magnetic properties of Coordination compounds.
- 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 magnetic properties .To recollect the chemistry of lanthanides and actinides.
K2	CO2	To understand the magnetic properties of coordination compounds. 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

Magnetic properties of coordination compounds: *dia, para, ferro and anti ferro magnetism*- change in magnetic properties of complexes in terms of spin orbit coupling - temperature independent paramagnetism - spin cross over phenomena, quenching of orbital angular moment.

Chemistry of Inner transitionmetals: 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:

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

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

Essential and non-essential elements, Biochemistry of Sodium, potassium and chloride- The sodium-potassium pump, ATP cycle, Biochemistry of Calcium and Copper, Biological Function and toxicity of Some Elements (Cr, Mn, Co, Ni, Se, Mo, Cd, Pb).

Unit-5

Bioinorganic chemistry:II

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, 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.

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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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: M.Rubini Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY4E3**	**Major Elective -III Applied Electrochemistry**	**Batch :**	2017-2019
			Semester	IV
Hrs/Week:	5		**Credits:**	3

Course Objective

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

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

Unit-2

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-electrodimerisation - adiponitrile.

Unit-3

Electrometallurgy and Electroplating

Electro winning 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

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

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, 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
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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: R.Mini Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

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

Course Code:	17PCY413	Physical methods in Chemistry	Batch :	2017-2019
			Semester	IV
Hrs/Week:	5		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 thermoanalytical methods.
- To gain knowledge in ESR, Mossbauer spectroscopy and AAS, AES, Poarimetry 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

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, 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:

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.

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

Unit-3

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

Electron spin resonance:

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

Mossbauer spectroscopy:

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

Unit-5

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, 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: R.Mini Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY207**	**Inorganic Chemistry Practical -I**	**Batch :**	2017-2019
			Semester	I &II
Hrs/Week:	5		**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 - Thallium, Tungsten, Selenium, Tellurium, Molybdenum, Cerium, Thorium, Titanium, Zirconium, Vanadium, Beryllium, Uranium and Lithium.

Note: A minimum of FI+VE inorganic mixtures, each containing of two common 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, Hydroxyl- aminehydrochloride, 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.

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

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Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY208**	**Organic Chemistry Practical -I**	**Batch :**	2017-2019
			Semester	I &II
Hrs/Week:	5		**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

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**
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Name:M.Rubini Signature:	Name: Dr.K.Poonkodi Signature:	Name: Dr.M.Durairaju Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY209**	**Physical Chemistry Practical -I**	**Batch :**	2017-2019
			Semester	I &II
Hrs/Week:	5		**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 macro 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

B. Precipitation titrations (using silver electrode)

9. Titration of Potassium chloride against Silver nitrate
10. Titration of mixture of halides (chloride and iodide) against silver nitrate

C. Redox titrations

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

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.

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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.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY414**	**Inorganic Chemistry Practical -II**	**Batch :**	2017-2019
			Semester	III &IV
Hrs/Week:	4		**Credits:**	3

Course Objective

- To get an idea about the industrial analysis of alloys.
- To know and apply the principle of complexometric titration.
- To understand some chromatographic techniques.
- To get an idea about the quantitative analysis of mixture of cations using volumetric and gravimetric principles.

Course Outcomes (CO)

K3	CO1	To recollect the nature of alloys. 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 alloys, 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 analyze the mixture of alloys. To estimate the cations using complexometric titration. To prepare coordination compounds by two stage preparation. To estimate the amount of individual cations present in a mixture using volumetric and gravimetric technique.

A. Industrial analysis: (Not for ESE)

Analysis of any two of the following alloys

Brass, Bronze, Stainless steel, Solder & Type metal.

B. Titrimetry:

Complexometric titration involving EDTA.

Estimation of Calcium, Magnesium, Nickel, Zinc and Hardness of water

C. Preparation:

Analysis and study of the properties of at least five coordination

Complexes (single stage / two stage preparations).

D. Quantitative estimation:

Mixture of cations involving volumetric and gravimetric estimation:

Copper & Nickel, Iron & Nickel, Iron & Magnesium 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.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY415**	**Organic Chemistry Practical -II**	**Batch :**	2017-2019
			Semester	III &IV
Hrs/Week:	4		**Credits:**	3

Course Objective

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

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:

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

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 and estimations: (Not for ESE examination**)**

1. Lactose from milk
2. Caffeine from tea
3. Nicotine from tobacco extract
4. 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, thin layer and ion – exchange (Demonstration only)

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

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

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**17PCY416**	**Physical Chemistry Practical - II**	**Batch :**	2017-2019
			Semester	III &IV
Hrs/Week:	4		**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 preen tint 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.

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