

M.PHIL. SYLLABUS – 2015

CHEMISTRY



DEPARTMENT OF CHEMISTRY
ST. JOSEPH'S COLLEGE (Autonomous)
Accredited at A Grade (3rd cycle) by NAAC
College with Potential for Excellence by UGC
Tiruchirappalli – 620 002

GUIDELINES FOR FULL TIME M.PHIL.

1. Duration : The programme runs for one year consisting of two semesters. The Semester- I is from August to February and the Semester- II runs from March to August, of the following year.

2. Course Work:

Semester - I			Semester - II		
Course	Title	Cr	Course	Title	Cr
C1	Professional Skills for Teaching – Learning	3	C5	Dissertation (Topic selected should be relevant to the topic of the Guide Paper)	8
C2	Research Methodology	4			
C3	Core Course	5			
C4	Guide Paper	5			
Total		17	Total		8

2. a) Each Course should contain 5 units, covering the subject requirements of the courses offered.

Marks for CIA and SE are in the ratio 40 : 60.

The CIA components are **Mid Semester Test (25), End Semester Test (25), Seminar (15), Objective Type Assignment Test (15)**. The total mark 80 will be converted into 40 marks. **The tests and Semester Examination are centrally conducted by COE for 3 hours.**

CIA & SE	Tentatively on
Mid Semester Test	December 2 nd Week
End Semester Test	February 2 nd Week
Semester Examinations	February 4 th Week

Scholar should acquire **a minimum of 20 marks from CIA to appear for SE**. The Scholar should acquire a minimum of 30 marks in Semester Examination. He / She will be declared to have passed in the various courses in Semester I, provided he/she secures not less than 50 marks on an aggregate (CIA+SE).

2. b) (i) In course C1 on **‘Professional Skills for Teaching – Learning’** the first three units are common to all the Departments of the College. The Academic Council has granted permission to incorporate some modifications in the C1 Course by Physics, Computer Science and Mathematics Departments. The first three unit titles are **Soft Skills, E-teaching, E-learning, Elements of Technology of Teaching and Learning**. The remaining two units are department specific to make use of the above mentioned skills & techniques to teach the Core Course.

The C1 Course is (to be) designed to exploit the various Teaching – Learning – Research Skills to be imbibed / cultivated to make the research scholars to be fit for the profession they are likely to acquire in the Education Industry. Thus only for the course (C1) the written component is 60% and Practical component is 40% both in CIA and SE.

b) (ii) **Evaluation for C1:**

Theory Component: For both CIA & SE, there will be a 2 hour test only from the first THREE units. The CIA components are Mid Semester Test (35), End Semester Test (35) and Assignment (30). The total 100 will be converted into 25 marks.

Practical Component: The last TWO units are department specific. There is no Mid and End Semester Tests. But the CIA for the same are assessed continuously by the teacher(s) concerned totaling 15 marks. For SE, the Practical evaluation is done by an external examiner.

- c) Question papers for C1, C2 & C3 are set by External Examiners.
- d) Question paper for C4 will be set and valued by the Research Advisor only.
- e) Departments will be permitted to offer either paper 2 or paper 3 as Open Online Course to the M.Phil. students. The evaluation method will be the same for both C2 and C3 Courses.

3. Credits:

SEMESTER – I	Courses	Title		Contact Hrs.	Library Hrs.	Total Hrs.	Cr	CIA Mk.	SE Mk.	Total Mk.
	C1	Professional Skills for Teaching – Learning	T	3	2	5	2	25	35	60
			P	2	2	4	1	15	25	40
	C2	Research Methodology		5	4	9	4	40	60	100
	C3	Core Course		5	5	10	5	40	60	100
	C4	Guide Paper		5	5	10	5	40	60	100
Total				20	18	38	17	160	240	400

SEMESTER – II	C5 – DISSERTATION	INTERNAL			EXTERNAL		
			Cr	Mk		Cr	Mk
		Seminar & Review of Related Literature	2	15	Dissertation Evaluation	6	75
		Mid Term Review Presentation	2	15	<i>Viva-voce</i>	2	25
		Dissertation Work	3	60			
		<i>Viva-Voce</i>	1	10			
Total			8	100		8	100

4. Question Pattern:

Science	Course	Mid & End Semester Tests and Semester Examinations		
	C1	Section A : Short Answers	7/9	7 x 2 = 14
		Section B : Either / Or – Essay Type	3	3 x 7 = 21
	C2	Section A : Short Answers	10	10 x 2 = 20
		Section B : Either / Or – Essay Type	5	5 x 8 = 40
C3	Section A : Short Answers	10	10 x 2 = 20	
	Section B : Either / Or – Essay Type	5	5 x 8 = 40	
C4	Open Choice : Comprehensive Type	5/8	5 x 12 = 60	
Arts	Course	Mid & End Semester Tests and Semester Examinations		
	C1	Section A : Short Answers	7/9	7 x 2 = 14
		Section B : Either / Or – Essay Type	3	3 x 7 = 21
	C2	Open Choice : Comprehensive Type	5/8	5 x 12 = 60
	C3	Open Choice : Comprehensive Type	5/8	5 x 12 = 60
C4	Open Choice : Comprehensive Type	5/8	5 x 12 = 60	

5. Dissertation

For carrying out the dissertation, it is mandatory to strictly adhering to the rules of the college as given below:

5.1. Requirement

Every student is expected to give two seminars one concerning Review of Related Literature within the four weeks from the beginning of the second semester and the other on Data Analysis/Result/Mid Term Review just before the submission of the final draft of the dissertation

5.2. Submission

Candidates shall submit the Dissertations to the Controller of Examinations **not earlier than five months but within six months** from the date of the start of the Semester –II. The above said time limit shall start from the 1st of the month which follows the month in which Semester - I examinations are conducted. If a candidate is not able to submit his/her Dissertation within the period stated above, he/she shall be given an extension time of **four** months in the first instance and another **four** months in the second instance with penalty fees. If a candidate does not submit his/her Dissertation even after the two extensions, his/her registration shall be treated as cancelled and he/she has to re-register for the course subject to the discretion of the Principal. However the candidate need not write once again the theory papers if he/she has already passed these papers.

At the time of Submission of Dissertation, the guide concerned should forward the marks for 90% as stated above to the COE in a sealed cover

5.3. All the M.Phil. Scholars (along with their Guides) have to submit at least one Research articles for publication, at the time of submitting the dissertation.

Departments (with the constituted Expert Committee) will scrutinize; select and recommend the best articles for a publication either in RETELL or in School-based Journals.

5.4. Requirement

For the valuation of dissertation it is mandatory to have passed in all the four courses. One external examiner and the Research Adviser shall value the Dissertation. The external examiner should be selected only from outside the college and shall be within the colleges affiliated to Bharathidasan University. In case of non-availability, the panel can include examiners from the other university/colleges in Tamil Nadu. The external examiner shall be selected from a panel of 3 experts suggested by the Research Adviser. However, the Controller of Examination may ask for another panel if he deems it necessary. Both the internal and external examiner will evaluate the Dissertation and allot the marks separately. However the *viva-voce* will be done by both of them. The average marks will be considered.

5.5. Viva-Voce

The external examiner who valued the Dissertation and the Research Adviser shall conduct the *Viva-Voce* for the candidate for a maximum of 100 marks. A Candidate shall be declared to have passed in *viva-voce* if he/she secures not less than 50% of the marks prescribed for Dissertation and 50% of the marks in the aggregate of the marks secured in *viva-voce* and Dissertation valuation. A student can undertake dissertation in the second semester whether or not he/she has passed the first semester.

6. Classification of Successful Candidates

6.1. The candidates who pass the Semester– I and Semester – II examinations in their first attempt shall be classified as follows:

S. No.	Total Marks secured in Semester – I and Semester–II Examinations	Classification
1.	80% and above in the case of Science Subjects & 75% and above in the case of Arts and Social Science Subjects	I Class with Distinction
2.	60% to 79% in the case of Science Subjects & 60 % to 74% in the case of Arts and Social Science Subjects	I Class
3.	50% to 59% in all the subjects	II Class

Note: Mathematics, Statistics and Computer Science/Application shall be treated as Science Subjects

6.2. Candidates who have failed in the courses may take the supplementary exams conducted by the COE immediately. Even then if they could not complete the course(s), they will be given two more chances only to appear for those courses along with the next batch scholars. The maximum duration for the completion of the M.Phil. Programme is 2 Years.

7. Attendance:

Daily attendance for 90 working days should be enforced for the students. Periodical report of a student to the guide concerned should be recorded in the register kept by the guide.

8. **The Scholar must obtain 80% of attendance per semester in order to appear for the Semester Examinations/Viva-Voce.**

M.PHIL. CHEMISTRY COURSE PATTERN — 2015

Sem	CODE	TITLE OF THE PAPER
I	15 MCH 101	Course — C1: Professional Skills for Teaching – Learning
	15 MCH 102	Course — C2: Research Methodology
	15 MCH 103	Course — C3: Selected Topics In Chemistry (Open Online Course)
	15 MCH 104 A	Course — C4: Principles of Advanced Coordination Chemistry
	15 MCH 104 B	Course — C4: Reactivity of Ether Linkage
	15 MCH 104 C	Course — C4: Advanced Studies of Macrocyclic Complexes
	15 MCH 104 D	Course — C4: Advanced Techniques in Coordination Complexes
	15 MCH 104 E	Course — C4: Corrosion Inhibition on Metals
	15 MCH 104 F	Course — C4: Kinetics and Catalysis
	15MCH 104 G	Course — C4: Natural Products Chemistry
	15.MCH 104 H	Course — C4: Organometallic Compounds
	15 MCH 104 I	Course — C4: Recent Trends in Coordination Chemistry
	15MCH 104 J	Course — C4: Recent Advances in Coordination Chemistry
	15 MCH 104 K	Course — C4: Thermodynamics of Liquid Solutions
	15 MCH 104 L	Course — C4: Electroorganic Chemistry
	15 MCH 104 M	Course — C4: Principles and Applications of Coordination Chemistry
	15MCH 104 N	Course — C4: Physical Methods in Coordination Compounds
	15 MCH 104 O	Course — C4: Surface Chemistry
II	15 MCH 205	Course — C5 : Dissertation

15MCH 101

C1: PROFESSIONAL SKILLS FOR TEACHING – LEARNING

Objectives:

- i. To empower scholars with soft skills
- ii. To introduce the techniques and dynamics of teaching
- iii. To facilitate e-learning/e-teaching with the ICT tools
- iv. To know the material resources for classroom teaching
- v. To introduce soft skill for class room teaching

UNIT I: Soft Skills

- a. Introduction to soft skills, soft skills vs. hard skills, types of soft skills
- b. Communicative skills – basics in communication, structure of written and oral sentences, verbal, non-verbal, body language, JOHARI Window, intrapersonal and interpersonal communications, activities in effective communication
- c. Behavioral skills – leadership skills, time management, creativity and lateral thinking
- d. Interview skills – resume writing, different types of interviews, etiquettes in interviews, mock interviews
- e. Team building and group discussion – progressive stages of team building, parameters of GD (special reference to attending, listening, responding skills), mock group GDs

UNIT II: Techniques and dynamics of teaching – learning

- a. Emerging trends in educational psychology – meaning, scope and methods
- b. Learning different theories of learning, approaches to learning (classical conditioning – Ivan Pavlov, operant conditioning – B.F. Skinner); kinds of learning, factors affecting learning
- c. Motivation: intrinsic and extrinsic motivation, development of memory and intelligence

UNIT III: e-Learning and e-Teaching

An overview of MS Office 2007, MS WORDS-2007, MS EXCELL-2007-MS Powerpoint-2007, concepts in e-resources and e-design: world wide web concepts – making use of web resources – website creation concepts – creating web page editions – creating web graphics – creating web audio files

UNIT IV: Material resources for class room teaching

Referencing books, journals, etc. internet resources, preparation of lecture materials – questions and exercises – preparation of question banks – documentation of the material resources in hard and soft forms

UNIT V: Class room teaching

Presentation skill – dress code – body language – eye contact – voice modulation – clarity of expression – black board writing – use of tools like charts, models, power point materials, hand outs, motivation of students – group discussions – problems solving sessions – short tests

References

UNIT I

1. JASS (2013). Winners in the making. Introduction to soft skills. St. Joseph's college, Trichy
2. Murphy, Raymond. (1998). Essential English grammar. 2nd ed. Cambridge university press
3. Trishna (2004). Knowledge system how to do well in GDs and interviews. Reprographic and printing services, Secunderabad

UNIT II

1. Covey, Stephen. (2004). 7 habits of highly effective people, free press
2. Driscoll, M P (1994). Psychology of learning for instruction, needham, ma: allyn and bacon
3. Gardner, Howard (1983; 1993). Frames of mind: the theory of multiple intelligences, new York; basic books

UNIT III

1. Joyce cox, Curtis Fryeetc (2007), step by 2007 Microsoft office system, prentice hall of india pvt Ltd, New Delhi

UNITS IV and V

2. Educational psychology in class room by Lindaren Hendry
3. Psychology of class room learning – Holt Richard

C2: RESEARCH METHODOLOGY

Objectives

- To know the information about research journals for publication and writing the thesis
- To introduce the students to C-language and enable him to solve simple programs in C.
- To learn functional group inter conversion and stereochemical aspect
- To know the difference between separation and purification

Unit I: Information Retrieval & Documentation

Sources of information -Primary, secondary, tertiary Sources-Journals-Abstracts-Current Titles-Reviews-Monographs-Dictionaries-Information retrievals using internet and other electronic medias [Preparing a review Article related to the problem of Research of the student]. Reports of Research Work - Laboratory Observation- Preparation of Records Manuscripts-Research Paper formats in *Indian J.Chem.*, *J.Indian Chem.Soc.*, *J.Am.Chem.Soc.*, *Tetrahedron*, *J. Chem.Soc-Dalton Trans*, *J.Chem. Education* Writing the project report or thesis.

Unit II: Statistical Tools of research

Significant figures, Precision, accuracy, Error analysis, types of errors. Mean, median, measures of spread – range, standard deviation and variance – F test, t test – Types of correlation, correlation coefficient, Regression analysis – binomial distribution, normal distribution – hypothesis generation and testing of hypothesis

Unit III: Computers in Chemistry

C Language & Programming- Constants, variables, function – Logical & Arithmetic statements – IF and ELSE statements simple programming examples from chemistry Temperature conversion, Calculation of frequency of electromagnetic Radiation, Cv of Solid (Cv at $T < 30$ K and at $T > 30$ K), Activity coefficient of Electrolytes, Rate constants of I & II order reactions, $t_{1/2}$ of I, II & III order reactions, Calculation of Arrhenius Parameters, Calculation of Modes of Vibration – Methods to draw and design structures – Chem sketch

Unit IV: Methods of organic synthesis

Introduction of Functional Groups- Interconversion of functional groups like C=O, -CHO, -OH, -SH, -COOH, -NH₂, -COOR, -CONHR, C=C .

Protection of some functional groups – Regioselective, Regiospecific and Stereoselective alkylation of cyclic Ketones & enones – Enamines and selective alkylation – Olefination of Carbonyl compounds - Wittig reaction.

Synthons and synthetic equivalents – Retro synthetic Analysis of simple organic compounds- mono & bi-functional open chain target molecules, mono & bicyclic target molecules - Multi-step organic synthesis.

Applications of the reagents, Collins reagent, PCC, DDQ, DIBAL, LDA, Simmons-Smith reagent, Wilkinson's catalyst, Weinraeb reagent, Al(*OBu-t*)₃, NaCNBH₃, SeO₂

Unit V: Methods of separation

Distinction between separation and purification – basic principles of separation techniques – filtration, crystallization, fractional crystallization, solvent extraction, distillation

Chromatography- Paper, Column, Ion-exchange, GC and HPLC techniques and applications

References

Unit: I:

1. C R Kothari, 2004, Research methodology : Methods and techniques New age International
2. Anderson, Assignment and Thesis writing.

Unit: II:

1. Eckschlager K., 1969, "Errors, Measurement and results in chemical analysis", London, Van Nostrand Reinhold company

Unit: III:

1. E. Balagurusamy, 1995, "C++" 1st ed, New Delhi, Tata McGraw Hill.
2. Puneet Nayyar, Sputi Trehan, Samrat Sharma, 2002, C Adventure – Beginners Guide to C- Programming, Diamond Jubilee Publication, NISCOM, New Delhi.

Unit: IV:

1. Stewart Warren, 1984, "Designing Organic Synthesis: The disconnection approach", Wiley, New Delhi.
2. R K Mackie and D M Smith, 1982, "Guide book to organic synthesis", London, ELBS.

Unit: V:

1. Budhiraja, 2007, Separation Chemistry, 2nd Edition, New Age International (P) Ltd, New Delhi
2. Willard H H, Merrit W Dean and Settle, 1986, " Instrumental methods of analysis", 6th ed., New York, CBS Publishers and distributors

C3: ADVANCED TOPICS IN CHEMISTRY*(Open Online Course)***Objectives**

- i. To know the applications of UV-Visible, IR spectroscopy and Mossbauer spectroscopy in the study of coordination compounds
- ii. To study nuclear magnetic resonance techniques and mass spectrometry
- iii. To understand the basic concepts of ultrasonic's and nano chemistry.
- iv. To learn about microwave assisted reactions and chemistry of macrocyclic complexes.
- v. To know the fundamentals of cheminformatics and drug design

Unit I:

UV Visible spectroscopy Microstates - Term symbols and energy levels for d^1 - d^9 systems – Electronic spectra of transition metal complexes (from d^1 to d^9 configurations) – intensity of bands – Evaluation of 10 Dq and Δ_0 values for octahedral complexes of cobalt and nickel – charge transfer spectra.

IR and Raman spectroscopy Combined applications of IR and Raman spectroscopy in structural elucidation of simple molecules and ions like N_2O , ClF_3 , NO_3^- and ClO_4^- – uses of group vibrations in the structural elucidation of metal complexes of urea, thiourea, cyanide, thiocyanate, nitrate, sulphate and dimethyl sulfoxide – IR spectra of metal carbonyls with reference to the nature of bonding, geometry and number of C-O stretching vibrations

Mossbauer Spectroscopy : Principle – isomer shift – electric and magnetic quadrupole splitting – applications to iron and its compounds

Unit II:

PMR spectroscopy – Principle – chemical shift – characteristic chemical shift values of various protons and carbons – coupling constants – factors affecting coupling constants – long-range coupling – Lanthanide shift reagents

^{13}C NMR spectroscopy – chemical shift – types of carbons and their signals and splitting – NOE phenomena – DEPT – broad band and OFF resonance decoupling

Mass spectrometry – principle – importance of meta stable peak – pattern of fragmentation – nitrogen rule – Mc Lafferty rearrangement

Determination of structure of organic compounds using UV, Vis, NMR and Mass spectra

Unit III

Nanochemistry Introduction – nanotechnology and nano machines – molecular nanotechnology – methods of synthesis of nano materials – plasma arching, sol-gel method – electro deposition, ball milling – analytical tools to study nano materials (SEM, TEM & SPM) – applications of nano chemistry – CNT and its applications – molecular switches – rotaxanes – catenanes – lithography – nano biometrics – metal nano clusters – nano crystals – quantum wells, dots, wires, etc – biological materials – future applications

Sonochemistry Fundamentals of sound and ultrasound – cavitation and its principle – instrumentation – homogeneous and heterogeneous processes – sonoluminescence – uses in chemistry, material science, medicine and life – synthetic applications – esterification, saponification, hydrolysis, substitution, cannizaro reaction, Strecker's synthesis

Unit IV: Microwave assisted synthesis and Macrocyclic Chemistry

Microwave assisted synthesis Instrumentation – microwave assisted reactions in water (Hoffmann elimination, hydrolysis, oxidation of toluene) and in organic solvents (esterification, Fries rearrangement, Claisen rearrangement, Diels Alder reaction) – Solvent free microwave reactions: deacylation, deprotonation and saponification of esters

Macrocyclic Chemistry Design and synthesis of macro cyclic ligands (1+1 and 2+2) – Direct macro cyclic synthesis – template synthesis – kinetic and thermodynamic effects on synthesis – binucleating macrocycles – compartmental ligands – natural macrocyclic systems – Host-Guest chemistry – sequestration

Unit V: Cheminformatics

Definition – scope – use of cheminformatics – evolution – history – applications of cheminformatics – CHUCKLES (monomer level of molecules) – CHORTLES (regular mixtures) – CHARTS (Searchins) – contour of drugs – drug dynamics and kinetics – drug action – drug interaction – drug abuse – drug administration, distribution and elimination – pharmacodynamics – development of new drugs – economics of drug discovery – drug design with the help of computer tools – use of silica chips to find lead molecules – chemical parameters in drug design – physic-chemical parameters in drug design – structure based drug design

References:

<http://www.sjctni.edu/Department/CH/OOC/unit1.jsp>
<http://www.sjctni.edu/Department/CH/OOC/unit2.jsp>
<http://www.sjctni.edu/Department/CH/OOC/unit3.jsp>
<http://www.sjctni.edu/Department/CH/OOC/unit4.jsp>
<http://www.sjctni.edu/Department/CH/OOC/unit5.jsp>

Unit I

S. No	Topics	Type of Contents	Location
1	UV-Visible Spectroscopy, IR and Raman Spectroscopy	PPT	http://www.sjctni.edu/department/CH/ooc/uvvis.ppt http://www.sjctni.edu/department/CH/ooc/IR.ppt http://www.sjctni.edu/department/CH/ooc/Raman.ppt
2	IR and Raman	Web Content	Youtube videos on IR and Raman Spectroscopy

Unit II

S. No	Topics	Type of Contents	Location
1	PMR and ¹³ C-NMR spectroscopy	PPT	http://www.sjctni.edu/department/CH/ooc/PMR.ppt http://www.sjctni.edu/department/CH/ooc/NMR.ppt
2	PMR and ¹³ C-NMR spectroscopy	Web Content	www.youtube.com/watch?v=k0eR8YqcA8c www.youtube.com/watch?v=ROfzVAUb5ls www.youtube.com/watch?v=BeBcPQ9zGAA www.youtube.com/watch?v=8hL3GXctuo https://www.khanacademy.org https://www.youtube.com/watch?v=biH065y1I4

Unit III

S. No	Topics	Type of Contents	Location
1	Nano biometrics Nano preparation Sonochemistry Uses of Nanotube	PPT	http://www.sjctni.edu/department/CH/ooc/biometrics.ppt http://www.sjctni.edu/department/CH/ooc/nano preparation.ppt http://www.sjctni.edu/department/CH/ooc/sonochemistry.ppt http://www.sjctni.edu/department/CH/ooc/nanotube.ppt
2	Nano biometrics Nano preparation Sonochemistry Uses of Nanotube	Web Content	Youtube videos- sonochemical reactions sonochemistry - wikipedia www.unc.edu/depts/mtcgroup/litmeetings/sonochemistry.pdf https://uqu.edu.sa/files2/tiny_mce/plugins/.../files/.../nanochemistry.pdf

Unit IV

S. No	Topics	Type of Contents	Location
1	Microwave chemistry 1 Microwave chemistry 2	PPT	http://www.sjctni.edu/department/CH/ooc/microwavechemistry1.ppt http://www.sjctni.edu/department/CH/ooc/microwavechemistry2.ppt
2	Microwave chemistry 1 Microwave chemistry 2	Web Content	Youtube videos on macrocyclic compounds

Unit V

S. No	Topics	Type of Contents	Location
1	Cheminformatics	PPT	http://www.sjctni.edu/department/CH/ooc/cheminformatics.ppt
2	Cheminformatics	Web Content	Youtube videos on cheminformatics

C4: PRINCIPLES OF ADVANCED COORDINATION CHEMISTRY

Dr S R Bheeter

Unit I:

Methods of preparation of coordination compounds - Analysis and determination of molecular formula - Volumetric, gravimetric and colourimetric methods - Conductance and magnetic measurements of complexes

Unit II:

Theories of coordination - CF, MO, LF Theories - Merits and demerits - σ donor and π acceptor ligands - Carbonyls - Nitrosyls - Cyanides - Triphenyl phosphine complexes - Organo metallic compounds - Allene, alkyne and allyl complexes

Unit III:

Special application to the study of coordination compounds - Electronic spectra - IR spectra - NMR spectra - ESR spectra - Mossbauer spectra – PES

Unit IV:

Kinetics and reaction mechanism in coordination compounds - S_N1 , S_N2 , S_NCB mechanisms - Trans effect - Electron transfer and electron exchange reactions - Catalysis by organometallic compounds

Unit V:

Transition metal ion in biology - Iron enzymes - structure and their functions - Model system for molecular activation and corresponding biochemical system.

References

1. Kettle S F A, Physical Inorganic Chemistry: A Coordination chemistry Approach, 1996, Oxford, Spektrum.
2. Drago R.S., 1977, Physical methods in inorganic chemistry, London, Saunders Golden Sunburst Series, W.B.Saunders Company.
3. Huheey J.E., 1972, *Inorganic chemistry Principle structure and reactivity*, (second edition), New York, Harper & Row publishers.
4. Cotton F.A. and Wilkinson G., 1988, *Advanced inorganic chemistry*, (Third Edition) London, John Wiley & sons.

C4: REACTIVITY OF ETHER LINKAGE

Dr K Joseph Santhanaraj

Unit I:

Electronegativity order of elements - acid, base concepts - Lewis concept of acids and bases - reaction intermediates - formation and stability of carbocation and carbonium - reactions of carbocations by abstracting hydride - electronic and steric effect - concept of oxidation - reduction electronic concept - effect of polarity of solvents on type of reactions - purification of organic solvent like benzene, nitro benzene and acetonitrile

Unit II:

Aromatic electrophilic substitution reaction - formation of π -complexes and $\pi\pi$ complexes - electrophilic substitution in different homo-aromatic and Hetero aromatic compounds - aliphatic electrophilic substitution reactions - S_N1 mechanism - mechanism of elimination reaction E_1 , E_2 and E_1CB .

Unit III:

IR, NMR spectroscopy in structural determination of organic compounds - Principles of thin layer chromatography (TLC) and column chromatography and techniques for separating the different components present in the organic mixture - Principle of using different solvents of varying polarity.

Unit IV:

Different methods of formation of acetal - mechanism of acetal formation - stability of acetals - oxidation of ether by $KMnO_4$, $KBrO_3$ alkalies - metal halides.

Unit V:

Mechanism of action of N_2O_5 on methyl phenyl ethyl ether - mechanism of reaction of hypochlorous acid on anisole - migration of halogen in ortho rearrangement - action of $SnCl_4$ on acetals - Hunsdiecker reaction - mechanism, evidence and limitations of Hunsdiecker reaction.

References:

1. March J, 1992, *Advanced Organic Chemistry* (Fourth Edition), New York, John Wiley & sons.
2. Kemp W, 1993, *Organic Spectroscopy*, 3rd edition, London, ELBS with Macmillan.
3. Gould, E.S, 1959, *Mechanism and Structure in Organic Chemistry*, New York, Holt Rinehart and Winston.
4. Pine S.H.et,al, 1986, *Organic Chemistry* (Fourth Edition), Singapore, McGraw-Hill Book Company.
5. Dyer J.R, 1984, *Applications of Absorption Spectroscopy of organic compounds*, New Delhi, Prentice Hall of India.

15MCH 104 C

C4: ADVANCED STUDIES OF MACROCYCLIC COMPLEXES

Dr M Amaladasan

Unit I:

Methods of preparation of coordination compounds - Analysis and determination of molecular formula - Volumetric, gravimetric and colorimetric methods - Conductance and magnetic measurements of complexes

Unit II:

Theories of coordination - CF, MO, LF Theories - Merits and demerits - Macrocycles and their classifications - Synthesis of Macrocycles - Properties and applications

Unit III:

Special application to the study of coordination compounds - Electronic spectra - IR spectra - NMR spectra - ESR spectra - Mossbauer spectra – PES

Unit IV:

Kinetics and reaction mechanism in coordination compounds - S_N1 , S_N2 , S_N1CB mechanisms - Trans effect - Electron transfer and electron exchange reactions - Catalysis by organometallic compounds

Unit V:

Transition metal ions in biology - Iron enzymes - structure and their functions - Model system for molecular activation and corresponding biochemical system.

References:

1. Lee J.D., 1998, *Concise inorganic chemistry*, (sixth edition), London, ELBS.
2. Huheey JE., 1972, *Inorganic chemistry: Principle, structure and reactivity*, (second edition), New York, Harper & Row publishers.
3. Drago RS., 1977, *Physical methods in inorganic chemistry*, London, Saunders Golden Sunburst Series, W.B.Saunders Company.
4. Cotton FA and Wilkinson G., 1988, *Advanced inorganic chemistry*, (Third Edition), London, John Wiley & sons.

15MCH 104 D

C4: ADVANCED TECHNIQUES IN COORDINATION COMPLEXES

Dr A Paul Raj

Unit I:

Methods of preparation of coordination compounds – design and synthesis of macrocyclic complexes – template effect – Conductance studies - magnetic measurements of complexes – Gouy method

Unit II:

Theories of coordination - CF, MO, LF Theories - Merits and demerits - σ donor and π acceptor ligands - Carbonyls - Nitrosyls - Cyanides - Triphenyl phosphine complexes - Organo metallic compounds - Allene, alkyne and allyl complexes

Unit III:

Special application to the study of coordination compounds - Electronic spectra – Racah parameters- IR spectra - uses of group vibrations in the structural elucidation of metal complexes of urea, thiourea, cyanide, thiocyanate, nitrate, sulphate and dimethyl sulfoxide- - NMR spectra of fluxional molecules- ESR spectra -Factors affecting the magnitude of g and A tensors in metal complexes - Mossbauer spectra of Fe complexes – Photoelectron spectroscopy

Unit IV:

Kinetics and reaction mechanism in coordination compounds – acid hydrolysis and base hydrolysis mechanisms - Trans effect and its theories - Electron transfer and electron exchange reactions - Catalysis by organometallic compounds

Unit V:

Transition metal ion in biology - Iron enzymes - structure and their functions - Model system for molecular activation and corresponding biochemical system.

References:

1. Drago R.S., 1977, *Physical methods in inorganic chemistry*, London, Saunders Golden Sunburst Series, W.B.Saunders Company.
2. Lee JD, 1988, *Concise inorganic chemistry*, (sixth edition) London, ELBS.
3. Huheey JE., 1972, *Inorganic chemistry Principle structure and reactivity*, (second edition), New York, Harper & Row publishers.
4. Cotton F.A. and Wilkinson G., 1988, *Advanced inorganic chemistry*, (Third Edition) London, John Wiley & sons.

C4: CORROSION INHIBITION ON METALS

Dr A Peter Pascal Regis

Unit I:

Corrosion - definition- costs of corrosion - economic losses - Human life and safety – Types of corrosion: dry corrosion - wet corrosion - mechanisms - galvanic corrosion, concentration cell corrosion, atmospheric corrosion, soil corrosion, pitting corrosion, inter granular corrosion, waterline corrosion, stress corrosion, microbial corrosion

Unit II:

Factors influencing corrosion: Nature of metals: Position in galvanic series - over voltage - relative areas of anodic and cathodic parts - purity of metals - physical state of metal – nature of surface film - solubility of corrosion products. Nature of corroding environment temperature - Humidity - presence of impurities in atmosphere - influence of pH - nature of ions present conduction of the corroding medium - formation of oxygen concentration cell.

Unit III:

Corrosion control: Proper designing - use of pure metals - using metal alloys – cathodic protection -sacrificial anodic protection method - impressed current cathodic protection - Use of inhibitors: inhibitors - definition - classification - due to Putilova - due to Deano - anodic - cathodic – mixed

Unit IV:

Theories of inhibition of corrosion: Adsorption theory and molecular structure - hydrogen over potential theory, film formation theory - synergistic effect - example - corrosion inhibition in neutral gaseous environments - chromate, molybdates, nitrite, phosphate, silicate, cations, organic inhibitors carboxylate and tannins.

Unit V

Phosphates as inhibitors: Phosphonates: definition - reasons for using Phosphonates as inhibitors - Use of HEDP, ATMP, ethyl phosphonic acid, 2-carboxyethyl phosphonic acid as corrosion inhibitors.

References:

1. Antropov.L., 1972, *Theoretical electro chemistry*, Moscow, Mir Publishers.
2. Bockris.J.O.M. and Reddy A.K.N, 1970, *Modern Electro chemistry* Volume I and II, New York, Plenum Press.

C4: KINETICS AND CATALYSIS

Dr.A.Peter Pascal Regis

Unit-I:

Factors influencing the rate of a reaction. Methods of determining order of a reaction. Mechanism of complex reactions –Equilibrium approximation –Steady state approximation-Product study –stoichiometry- Isokinetic relation –Isokinetic temperature-Exner plot-Nature of reaction series and selectivity.

Unit-II:

Arrhenius equation –Activated complex theory- Chain reaction(Photo Chemical and thermal reaction)-Chain initiation process-Hydrogen-halogen reaction-Branching chain reaction-Gas phase combustion H_2O_2 reaction-Explosive reaction

Unit-III:

Application of ARRT in solution kinetics –Factors affecting reaction rate in solution Influence of internal pressure – influence of solvent dielectric constant-influence of ionic strength ion dipole and dipole –dipole reactions - influence of hydrostatic pressure – Vant Hoff equation and volume of activation Kinetic isotope effect-Primary and Secondary isotope effect

Unit-IV:

Acid-base catalysis - Mechanism of acid base catalysis – Vant Hoff intermediate, Arrhenius intermediate protolytic and prototropic mechanism - Catalysis law. Acidity functions – Hammett-Zimmerman hypothesis –catalysis in biological systems –Enzyme catalysis – Michaelis-Menten equation-Line -Weaver-Burk and Eadie-Hofster Plots - influence of substrate concentration - influence of pH - influence of temperature-influence of substituents on reaction rates –Hammett and Taft equations-Linear free energy relationships-kinetics of biological oxidation reaction and mechanism

Unit-V:

Surface phenomena-Adsorption and free energy relations at interface - Gibbs adsorption isotherm-physical and chemical adsorption - Langmuir adsorption isotherm - BET isotherm-Measurement of surface area - Heterogeneous catalysis - Role of surface in catalysis-Mechanism of Heterogeneous catalysis-Langmuir-Hinshelwood mechanism of bimolecular reaction - Langmuir-Rideal mechanism of bimolecular reaction

References:

1. Chemical kinetics-Laidler.K.J
2. Investigations of Rates and mechanism of Reaction PartI-Edward.S.Lewis
3. Kinetics and Mechanism-Frost.A and Pearson.R.C
4. Kinetics and Mechanism of Chemical transformation –Kuriacose J.C. and Rajaram
5. Radiation chemistry-Hughes.G.

Dr V Alex Ramani

Unit I: Plants and Plant Products

Classification of Plants - Nomenclature - Cells - Tissues - Structures and Functions of Cells and tissues - Primary Metabolites - Secondary Metabolites - Microorganism- Types - Microbes and Man - Biological Activities - Microbial Studies - Techniques - Interpretation of Results

Unit II: Methods of Plant Analysis I

Methods of Extraction - Cold Percolation Method - Soxhlet Method - Methods of Isolation - Methods of Separation- Chromatography - Paper Chromatography - Column Chromatography - Thin layer Chromatography - Gas Chromatography - High performance Liquid Chromatography Electrophoresis - Paper and Gel Electrophoresis - Distillations - Steam Distillation - Fractional Distillation - Vacuum Distillation - Crystallization Techniques

Unit III: Methods of Plant Analysis II

UV-VIS spectroscopy - IR Spectroscopy - Proton and Carbon-13 NMR Spectroscopy – Mass Spectroscopy - X-ray and Neutron Diffraction studies - Optical studies - Qualitative and Quantitative Analyses - Interpretation of Results

Unit IV: Phenolic Compounds and Terpenoids

Methods of separation, isolation and identification - Phenolics - Phenyl propanoids - Anthocyanins - Flavonoids - Xanthones - Stilbenes - Chemical conversions of these compounds - Structure Elucidation of Quercetin, Vitexin and Naringin Methods of separation, isolation and identification - Monoterpenes - Sesquiterpenes - Diterpenes - Triterpenoids - Steroids - Carotenoids - Chemical conversions of these compounds - Structure Elucidation of Menthol and Carotol.

Unit V: Nitrogen Compounds, Sugars, Lipids and other related Compounds

Methods of separation, isolation and identification - Amino acids - Proteins - Peptides - Amines - Alkaloids - Cyanogenic glycosides - Purines - Pyrimidines - Cytokinins - Chlorophylls - Chemical conversions of these compounds - Structure Elucidation of Nicotine and Cytisin. Methods of separation, isolation and identification - Monosaccharide - Disaccharide - Polysaccharides - Shikimic acids - Quinic acid - Fatty acids - Polyacetylenes – Sulfur compounds - Chemical conversions of these compounds - Structure Elucidation of Shikimic acid and Rhanmonse.

References:

1. Peach K and Tracey MV (eds.), 1956-1964, *Moderne der pfranzanalyse*, Berlin, Spingerverlag.
2. Krishnasamy N.R, 1999, *Chemistry or Natural Products*, Hyderabad, University Press.
3. Boyer RF, 1993, *Modern Experimental Biochemistry*, II Ed., California, The Benjamin Cummings publishing company Inc.

4. Furniss BS, Hannaford AJ, Smith PWG and Tatchell AR, 1989, *Vogel's Text book of Practical Organic Chemistry*, V Ed., Essex, England, ELBS with Longman.
5. Harborne JB, 1988, *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*, II Ed., London and New York, Chapman and Hall.
6. Finar I.L. *Organic Chemistry*, Vol. 2. ELBS London.
7. Raphael Ikan, 1969, *Natural Products: A Laboratory Guide*, Jerusalem, Israel University Press.
8. Jeffrey C, 1982, *An Introduction Plant Taxonomy*, II Ed., Cambridge, Cambridge University Press.
9. William J and Sham M, 1976, *Microorganisms*, London, Mills and Boon Limited.
10. Ari Koskinen, 1993, *Asymmetric Synthesis of Natural Products*, Chichester, New York, Brisbane, Toronto, Singapore, John Wiley and Sons.

C4: ORGANOMETALLIC COMPOUNDS

Dr. S. Joseph Selvaraj

Unit I:

Organometallic compounds-Olefin complexes, and cyclopentadienyl complexes, Bonding in ferrocene compounds, Arene metal complexes, Alkyne complexes fluxional organometallic compounds and its identifications

Unit II:

Reactions of organometallic compounds-Homogeneous Catalytic reactions, Stereochemistry and mechanism of addition reactions, hydrogenation of alkenes, formylation and polymerization reactions.

Unit III:

Organometallic reagents- Lead tetraacetate, sodium ethoxide, Aluminium iso-propoxide, Dess-Martine reagent, silver, palladium and platinum compounds, Role of organometallic compounds in organic synthesis.

Unit IV:

Theory, instrumentation and applications of UV-spectroscopy, Instrumentation and Applications of IR spectroscopy with reference to organometallic compounds, NMR applications.

Unit V:

Applications of 2D-NMR techniques like COSY, HMQC, HMBC and NOESY. Applications of C-13 NMR spectroscopy, Mass spectral technique and its applications. Theory instrumentation and applications of Thermal experiments-TG, DTA, and DSC

References:

1. V.K. Ahluwalia, Renu Aggarwal, Organic synthesis, Second Edition, (Narosa Publications)
2. Cotton F.A. and Wilkinson G., 1988, *Advanced inorganic chemistry*, (Third Edition) London, John Wiley & sons.
3. Robert M Silberstein and Francis X Webster, *Spectrometric identification of organic compounds*, Sixth Edition, John Wiley and Sons.

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C4: RECENT TRENDS IN COORDINATION CHEMISTRY

Dr. S. Denis Arockiaraj

Unit I:

Preparation methods of complexes-physical methods of determination of molecular formula-conductance, magnetic measurement – faraday method – Gouy method

Unit II:

Theories of coordination compounds-VBT, CFT, MOT, LFT-merits and demerits. Sigma donor and pi-acceptor ligands- preparation, structure and reactivity of organometallic complexes

Unit III:

Applications of spectroscopic methods in the study of coordination complexes
NMR – fluxional complexes - IR-Effect of coordination on ligand vibrations – Metal-ligand vibrations - Mossbauer spectroscopy of iron complexes – Electron paramagnetic resonance – theory and applications

Unit IV:

Kinetics and reaction mechanism in coordination complexes-SN1, SN2, SN1CB. Theories and applications of trans effect-inner sphere and outer sphere electron transfer reactions-two electron transfer reactions-catalysis by organometallic compounds – hydrogenation, hydroformylation, oxidation and polymerization

Unit V:

Bioinorganic chemistry-structure and functions of chlorophyll, haemoglobin, myoglobin, cytochromes and iron enzymes

References:

1. Drago R.S., 1977, *Physical methods in inorganic chemistry*, London, Saunders Golden Sunburst Series, W.B.Saunders Company.
2. Huheey JE., 1972, *Inorganic chemistry Principle structure and reactivity*, (second edition), New York, Harper & Row publishers.
3. Cotton F.A. and Wilkinson G., 1988, *Advanced inorganic chemistry*, (Third Edition) London, John Wiley & sons.
4. Peter Atkins, Fraser Armstrong, Jonathan Rourke, Mark Weller and Tina Overton, 2010, Shriver and Atkins' *Inorganic Chemistry*, Fifth Edition, Oxford University Press, New Delhi

C4: RECENT ADVANCES IN COORDINATION CHEMISTRY

Dr. A. N Paul Angelo

Unit I: Synthesis of Novel Coordination Compound

Design and Synthesis of macrocyclic Ligands - Synthetic Procedures - Direct Macrocyclic synthesis, Microwave assisted synthesis - Metal ion template synthesis – Macrocyclic systems Macrocycles with pendant functional group - Catenands, Cage macrocycles, Cryptands and Crown Polyethers – Binucleating macrocycles - Compartmental Ligands. Natural macrocycles - Host-guest chemistry- macrocyclic host and non-metallic guests.

Unit-II: Theories of Coordination Compounds and Mechanisms

Crystal Field, Ligand Field, Molecular Orbital Theories and Angular Overlap – Model Mechanism of Electron Transfer Reactions – Inner sphere and Outer sphere electron transfer mechanisms - Substitution reaction in square planar complexes, trans effect -Oxidative addition and insertion reactions.

Unit-III: Determination of Electronic Structure and Geometry of Coordination Compounds-I

Electronic spectroscopy: Electronic states and spectra of T_d and O_h complexes, charge transfer spectra LMCT, MLCT, crystal field spectra. Evaluation of values in $Co(III)$ O_h and $Ni(II)$ O_h complexes $D_{q_{xy}}$ and D_{q_z} in tetragonally distorted cobalt(II) octahedral complexes. Infrared and Raman spectroscopy: Structural diagnosis: IR spectral assignment of coordinated ligands in metal complexes and differentiation of isomers (CN/NC, OCN/NCO, SCN/NCS, CNO/ONC, NO_2/ONO) NMR Spectroscopy - Application of spin-spin coupling to structure determination. NMR of paramagnetic transition metal ion complexes, scalar shift and covalency. Lanthanide shift reagents. ESR anisotropy in the g-value, hyperfine and zero-field effect on the spectrum, Survey of the EPR spectrum of first row transition metals.

Unit-IV: Determination of Electronic Structure and Geometry of Coordination Compounds-II

Magnetic Behaviour of Coordination Compounds. Methods of determining magnetic susceptibility, and electron states - Electrochemical methods of studying coordination compounds. Electrochemical and electrochemical reversibility. Pulse polarography, AC Polarography, Cyclic voltammetry. Electrochemical synthesis of complexes. Coupled chemical reactions - EC, CE and ECE mechanisms. Photoelectron spectroscopy and X-PES - Study of chiral coordination compounds by ORD and CD - Mass Spectroscopy - CIMS, EIMS and FAB-MS.

Unit-V: Catalysis of Organometallic compounds and Bio-inorganics

Ziegler - Natta polymerization, cyclooligomerization, olefin isomerization, metathesis and polymer bound catalysis. The oxygen carriers- hemoglobin and myoglobin and synthetic oxygen carriers. Electron transfer agents - Cytochromes, iron-sulphur proteins. Mechanism of electron transfer reactions. Nitrogen Fixation. Essential and trace elements in biological systems. Chelate therapy. Applications.

References:

1. Lindoy.L.F, 1989, The Chemistry of Macrocyclic Ligand Complexes, Cambridge University Press, N.Y.
2. Huheey J.E., 1988, Inorganic Chemistry, 4th Edition. Harper and Row, NY
3. Cotton.F.A and Wilkinson.G 2001 Advanced Inorganic Chemistry, 6th Ed., Wiley Interscience, NY,
4. Purcell.K.F and Kotz. J.C. 1976, Inorganic Chemistry, Saunders.
5. Lever.A.B.P, 1984, Inorganic Electronic Spectroscopy, 2nd Ed., Elsevier Publishing Company, Amsterdam
6. Nakamoto. K, 1986, Infrared and Raman Spectra of Inorganic and Coordination Compounds, 4th Ed., Wiley interscience
7. Basolo F and Pearson .R.G, 1967, Mechanism of Inorganic reactions, 2nd Ed., Wiley Eastern. New Delhi.
8. Kissinger.P.T, and Heineman.W.B, 1984, Laboratory Techniques in Electroanalytical Chemistry, Editors, Marcel Dekker, Inc., New York
9. Drago R.S., 1977, Physical Methods in Inorganic Chemistry, Saunders, Amsterdam.
10. J. Chem. Educn., 1983, 60, 252-308.
11. J. Chem. Educn., 1983, 60, 687-706.
12. Eichhorn G.L., Ed., 1976, Inorganic Biochemistry, Elsevier, Amsterdam.

C4: THERMODYNAMICS OF LIQUID SOLUTIONS

Dr. A. Rose Venis

Unit I: Chemistry of Solutions

Concentration units- molarity, molality, mole fraction, volume fraction, percentage by weight and volume. Ideal and non-ideal solutions-Raoult's law, Henry's law, models in ideal and non-ideal solutions, their miscibility's, thermal properties, Binary and ternary liquid mixtures.

Unit II: Theories of Liquid Mixtures

Cell theory, Hole theory, lattice model, Prigogine's model, Flory theory, scaled particle theory, free length theory, Kharare equation, Kalidoss-Jacobson theory. Types of interactions in solutions.

Unit III: Review on Thermodynamic Properties

Review of thermodynamic properties of solutions. Liquid solutions of non-electrolytes and electrolytes- activity coefficient- Deby- Huckel theory and its implications- thermodynamics of mixing. Measurement of density, viscosity, heat of solution, heat of mixing and vapour pressure.

Unit IV: Ultrasonic Studies in Liquid Mixtures

Ultrasonic interferometer- principle, instrumentation, generation of ultrasonic waves, measurement of velocity, ultrasonic transducers. Calculation of excess volume, internal pressure, isentropic compressibility and its deviation, free volume, free length, relative association, acoustic impedance, molar sound speed, isothermal compressibility, thermal expansion coefficient, partial and apparent molar volume, excess viscosity, excess molar Gibbs free energy of activation, stability constants of complexes. Relation of ultrasonic velocity with hydrogen bonding, phases, boiling points, molecular interactions and electrolytes.

Unit V Applications of Ultrasonic Sound Waves

Ultrasonic testing - Laser ultrasonic- ultrasonics in medicine, biology and industry.Sonochemistry- ionic liquids.

References:

1. Gupta MC, 1990, Statistical Thermodynamics, Madras, Wiley Eastern Ltd.
2. Glasstone S, 2002, Thermodynamics for Chemists, New Delhi, East-West Press Ltd.
3. Rowlinson JS, 1971, Liquids and liquid mixtures, London, Butterworth.
4. Alexander Findlay and Kitchener J A, 1959, Practical Physical chemistry, 8th edition, Longmans Green and Co. Ltd.
5. Srivastava KC, 2001, Hand book of Ultrasonic testing, International Inspection services,
6. Kinsler LE and Frey AR, 1991, Fundamentals of Acoustics, 2nd ed, Wiley Eastern Ltd.
7. Bhaldev Raj, Rajendran V and Palanichamy, 2004, Science and Technology of Ultrasonics, Narosa Publishing House, Chennai.

C4: ELECTROORGANIC CHEMISTRY

Prof. S. Antony Sakthi

Unit I: Basic concepts of electroorganic chemistry

The contents of an electrolytic cell, electrode materials, anodes, cathodes. Electrolytic media- aqueous and non-aqueous media, Reference electrodes, salt bridges, Liquid-Junction potentials. Application of reference electrodes, diaphragms, permeable membranes and semi-permeable membranes. Designing of simple special cells.

Unit II: Electrochemical oxidation of some organic compounds

Oxidation of phenols, alcohols and glycols. Kolbe reaction, oxidation of carbonyl compounds - aldehydes, ketones, esters and lactones.

Unit III: Electrochemical reduction of some organic compounds

Carbon-Carbon bond formation reactions- acid and base catalyzed condensations. Carbon heteroatom bond formation reactions-Pericyclic reactions

Unit IV: Aromatic substitution reactions

Concepts of aromaticity, electrophilic substitution of aromatic compounds (like chlorination, bromination and sulphonation). Substituent effects on aromatic electrophilic substitution.

Unit V: Separation and characterization techniques

Chromatographic techniques. TLC, column chromatography, paper chromatography, high performance liquid chromatography (HPLC)-principle, methods and applications of ^1H NMR, ^{13}C NMR, FT-IR and UV spectra.

References:

1. Norman L. Weinberg, Techniques of electroorganic synthesis. Part I and Part II, 1975, John Wiley and Sons.
2. Mollwo Perkin F, Practical methods of electroorganic chemistry, 1905, Longmans, Green and Co.
3. March J. 1992, Advanced Organic Chemistry (Fourth Edition), New York, John-Wiley & Sons.

C4: PRINCIPLES AND APPLICATIONS OF COORDINATION CHEMISTRY

Dr A Edwin Vasu

Unit I: Preparation and characterization of complexes

Methods of preparation of coordination compounds –Detection of complex formation – colorimetric methods- Job’s method- stability constants of complexes - Conductance and magnetic measurements of complexes – electrochemical studies of coordination complexes

Unit II: Bonding in coordination compounds

Theories of coordination compounds- Crystal field theory, MOT and LFT- σ donor and π acceptor ligands–Structure and bonding in metal carbonyls, nitrosyls and cyanides - Organo metallic compounds - Allene, alkyne and allyl complexes

Unit III: Applications of spectral methods

Electronic spectra –selection rules – electronic spectra of complexes in cubic and square fields-charge transfer spectra -IR spectra - NMR spectra ^{15}N , ^{19}F and ^{31}P - ESR spectra hyperfine splitting – zero field splitting - Spectra of Mn(II), Fe(II), Co(II), Ni(II) and Cu(II) complexes - Mossbauer spectroscopy – basic principles and applications

Unit IV: Homogeneous catalytic reactions by complexes

Wilkinson’s catalyst - Ziegler-Natta polymerization – Fischer-Tropsch process – oxidation of alkenes - metathesis

Unit V: Bioinorganic chemistry

Oxygen carriers and oxygen transport proteins-Hemoglobin and myoglobin - Cytochromes and peroxidases -Vitamin B12.Medicinal applications of coordination complexes – detoxification by chelation therapy

References:

1. Drago R.S., 1977, *Physical methods in inorganic chemistry*, London, Saunders Golden Sunburst Series, W.B.Saunders Company.
2. Huheey J.E., 1972, *Inorganic chemistry Principle structure and reactivity*, (second edition), New York, Harper & Row publishers.
3. Cotton F.A. and Wilkinson G., 1988, *Advanced inorganic chemistry*, (Third Edition) London, John Wiley & sons.
4. Peter Atkins, Fraser Armstrong, Jonathan Rourke, Mark Weller and Tina Overton, 2010, *Shriver and Atkins’ Inorganic Chemistry*, Fifth Edition, Oxford University Press, New Delhi
5. Keith F. Purcell , John C. Kotz, 1977, *Inorganic Chemistry*, Cengage Learning, New Delhi
6. Kettle S F A,1996,*Physical Inorganic Chemistry: A Coordination chemistry Approach*, Oxford, Spektrum.

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C4: PHYSICAL METHODS IN COORDINATION COMPOUNDS

Prof. A. S. Stella Shalini

Unit I:

Methods of preparation of coordination compounds - Analysis and determination of molecular formula - Volumetric, gravimetric and colorimetric methods - Conductance and magnetic measurements of complexes

Unit II:

Theories of coordination - CF, MO, LF Theories - Merits and demerits - Macrocycles and their classifications - Synthesis of Macrocycles - Properties and applications

Unit III:

Special application to the study of coordination compounds - Electronic spectra - IR spectra - NMR spectra - ESR spectra - Mossbauer spectra – PES

Unit IV:

Kinetics and reaction mechanism in coordination compounds - S_N1 , S_N2 , S_N1CB mechanisms - Trans effect - Electron transfer and electron exchange reactions - Catalysis by organometallic compounds

Unit V:

Transition metal ions in biology - Iron enzymes - structure and their functions - Model system for molecular activation and corresponding biochemical system.

References:

1. Lee JD., 1998, *Concise inorganic chemistry*, (sixth edition), London, ELBS.
2. Huheey JE., 1972, *Inorganic chemistry: Principle, structure and reactivity*, (second edition), New York, Harper & Row publishers.
3. Drago RS., 1977, *Physical methods in inorganic chemistry*, London, Saunders Golden Sunburst Series, W.B.Saunders Company.
4. Cotton FA and Wilkinson G., 1988, *Advanced inorganic chemistry*, (Third Edition), London, John Wiley & sons.

Dr.A.Simi

Unit I: Adsorption and surface phenomenon

Physisorption and chemisorption, adsorption isotherms, Langmuir and B. E. T. equation and significance in surface area determination, surface films, states of insoluble films, L. B. films and their application, adsorption from solution, adsorption types, surface excess concentration, Gibb's adsorption equation: derivation, significance and experimental verification, catalytic activity of surfaces.

Unit II: Emulsion

Types of emulsion, theories of emulsion and emulsion stability, identification of emulsion types, inversion emulsion, microemulsion: theory and application.

Unit III: Liquid gas and liquid interfaces

Surface tension, capillary action, methods of determination of surface tension, surface tension across curved surfaces, vapor pressure of droplet (Kelvin equation), surface spreading, spreading coefficient, cohesion and adhesion energy, contact angle, constant angle hysteresis, wetting and detergency.

Unit IV: Solid - Solid interfaces and Chemical Kinetics

Surface energy of solids, adhesion and adsorption, sintering mechanism, Tammann temperature and its importance, surface structure and surface composition. Experimental methods of following kinetics of a reaction, chemical and physical (measurement of pressure, volume, EMF, conductance, diffusion current and absorbance) methods and examples. Order and methods of determination (Initial rate, Integration, graphical and half life methods), rate determining step, steady state approximation.

Unit - V: Thermodynamics

Thermodynamic scale of temperature – Entropy as a state function – Entropy as a function of P, V and T - Entropy change in phase change – Entropy of mixing – Entropy as a criterion of spontaneous and equilibrium processes in isolated systems – Gibbs function(G) – Hemholtz function(A) as thermodynamic quantities - Equilibrium constant and free energy change - Thermodynamic interpretation of Le Chatelier principle (concentration, Temperature, Pressure) - addition on inert gases – Reaction isotherm – Van't Hoff equation.

References:

1. Physical chemistry of surfaces: A. W. Adamson. Wiley-Interscience; VI edition, 1997
2. Theory of adsorption and catalysis by Alfred Clark, Academic Press, 1970.
3. Chemisorption by B. M. W. Trapnell and H.O. Hayward. Interscience Publishers, New York, 1963
4. Introduction to colloid and surface chemistry by D. J. Shaw. Fourth Edition, D. J. Shaw. Butter-worth/Heinemann, Oxford, 1992
5. Theories of chemical reaction rates by A. J. K. McGrew Hill, New York, 1969
6. Surface chemistry by J.J. Bikermann 2nd ed. J.J. Bikerman, Academic Press, New York, 1958.
7. Principles of Physical Chemistry – by Samuel H. Maron and Carl F. Prutton Hardcover Publisher IV edition – 1965
8. Physical Chemistry – G. M. Barrow, Tata-McGraw Hill, V edition, 2003.
