Shivaji University, Kolhapur

Department

of

Applied Chemistry

M. Sc. Part-I

Semester I & II

M. Sc. Part-II

Semester III & IV

New Syllabus

[New Syllabus under Academic Flexibility Scheme & Credit System]

(Subject to the modifications to be made from time to time)

Overview and New syllabus of the M. Sc course in Applied Chemistry from the academic year 2007-08 onwards

Co-ordinator….

SHIVAJI UNIVERSITY, KOLHAPUR

DEPARTMENT OF APPLIED CHEMISTRY

M. Sc. COURSE IN "APPLIED CHEMISTRY"

M. Sc. courses is a potential base provided by the Shivaji University, on the University Campus to educate and prepare post graduate student from rural and urban area who will get employment on large scale in the Indian Chemical Industries as well as in multinational pharma industry in order to enhance quality, standard and skilled training to the post graduate student well organized and planned affords of the Department of Chemistry will meet the global standards in post graduate teaching, research and training programmes. One of the objectives of M. Sc. course in Applied Chemistry is to meet the need and requirement of the modern society in a focused area to solve the humanities top most problems like energy, materials food, water & environment for next fifty years. M.Sc. course in Applied Chemistry will provide broad common frame work of syllabus to expose our young graduates to the recent and applied knowledge of interdisciplinary branches of the chemistry namely Organic, Inorganic, Physical, Analytical, Industrial, Pharmaceutical, Nanoscience and Technology. M. Sc. Applied Chemistry will lead to higher level of knowledge base which will useful for carrier development in academic field as well as new job opportunities in industrial sector.

Title of the Course: M. Sc. Applied Chemistry.

Eligibility of Course: Admission to the M. Sc. Applied Chemistry course will be open to candidates passing B. Sc degree in Chemistry of Shivaji University or any other statutory university, Institution in India or abroad with minimum 55% marks the candidate should have Chemistry as a principal subject of study at B.Sc. Course.

Selection Procedure: Selection for the M. Sc. course in Applied Chemistry will be based on common all India entrance test of Department of Chemistry and personal interviews passing standard for open category minimum 50% marks for reserve category minimum 40% marks will be called for personal interview. The merit list of eligible candidates will be displayed on Shivaji University web site. www.unishivaji.ac.in

Strength of the students: Total Seat: 60 Candidates
Open + reserve -27+27 Candidates [50% open + 50% reserve]
Other university-06 [10%]

Duration of the Course: The duration of the M. Sc. course in Applied Chemistry is of two years consisting of '4' semester, each semester spanning for 6' months of minimum 120 working days.

Period of the course Semester I & III from June to November and Semester II & IV December to May

Teaching faculties:

1. Professor cum -Co-ordinator, **-Dr. P. N. Bhosale**
2. Three- lecturers, **Mr. P. M. Chavhan** & other two to be appointed
3. Contributory staffs- 10 Professors, 10 Readers and 5 Lecturers
4. Experts from National institutes and Industries
5. Inter and intra Department faculty, , Professors, Readers, Lecturers, M. Tech., B. Tech. Industrial personnel etc. qualification of the teacher for M .Sc. Applied Chemistry will be M. Sc., M. Sc., Ph.D., M .Sc. M. Phil, M. Tech., B. Tech. in Chemistry.

The structure of M. Sc. Applied Chemistry Course:-

1) Theory course
2) Practical course
3) Seminars/ Tutorials

4) Industrial training/ Project work

Each semester will have theory examination of four papers of 100 marks each (Internal assessment caring a weightage of 20 % will be conducted after the coverage of 50% syllabus and semester examination will carry a weightage of 80% conducted at the end of completion of semester duration)

Practical Course:

Each Semester will have two practical courses of 100 marks each (Internal assessment caring a weightage of 20 % will be conducted after completion of 50% Practical and 80% weightage will be given to end examination of Semester).

Semester-IV will have two practical courses out of which one practical course will have 50 marks project work/ Industrial training completed in the industries/Laboratory.

Project Work/ Industrial Training/Review Articles: The evaluation of project work /Industrial Training/ Review Articles will be based on the work carried out in industry/ laboratory/ library and viva-voce/oral examination will be conducted jointly by internal & external examiner at the end of examination of semester IV. In case of industrial training the candidate will submit a certificate from the industry that he/she has undergone training and also a report. The evaluation will be made based on the report.

Discipline:

Every student is require to observe discipline and good behavior both inside and outside the institution/ Department and not to indulge in any activity which will tend to bring down the prestige of University/ Department

Evaluation and Credit System:

SEMESTER-I

Course No	Title	Hours per week		Examination/Evaluation of marks				
				Theory		Practical		Total
		L	P	Internal	Final	Internal	Final	
AC-101	Inorganic Chemistry-I	4		20	80	--	--	100
AC-102	Organic Chemistry-I	4		20	80	--	--	100
AC-103	Physical Chemistry-I	4		20	80	--	--	100
AC-104	Analytical Chemistry-I	4		20	80	--	--	100
AC-111	Inorganic Practical-I	--	3	---	--	10	40	50
	Organic Practical -I	--	3	---	--	10	40	50
AC-112	Physical Practical -I	--	3	---	--	10	40	50
	Analytical Chemistry -I	--	3	---	--	10	40	50

Total Marks for Semester-I 600

*Distribution of teaching hours/week: - Theory – 16 hours, Practical – 12 hours

Total hours – 28 hr

SEMESTER II

Course No	Title	Hours per week		Examination/Evaluation of marks				
				Theory		Practical		Total
		L	P	Internal	Final	Internal	Final	
AC-201	Inorganic Chemistry-II	4	---	20	80	---	---	100
AC-202	Organic Chemistry-II	4	---	20	80	---	---	100
AC-203	Physical Chemistry-II	4	---	20	80	---	---	100
AC-204	Analytical Chemistry-II	4	---	20	80	---	---	100
AC-211	Inorganic Practical-II	---	3	---	---	10	40	50
	Organic Practical –II	---	3	---	---	10	40	50
AC-212	Physical Practical –II	---	3	---	---	10	40	50
	Analytical Chemistry -II	---	3	---	---	10	40	50

Total Marks for Semester-II 600

*Distribution of teaching hours/week: - Theory – 16 hours, Practical – 12 hours

Total hours – 28 hr

SEMESTER III

Course No	Title	Hours per week		Examination/Evaluation of marks				
				Theory		Practical		Total
		L	P	Internal	Final	Internal	Final	
AC-301	Applied Inorganic Chemistry-I	4	---	20	80	---	---	100
AC-302	Applied Organic Chemistry-I	4	---	20	80	---	---	100
AC-303	Applied Physical Chemistry-I	4	---	20	80	---	---	100
AC-304	Applied Analytical Chemistry-I	4	---	20	80	---	---	100
AC-311	Applied Inorganic Practical-I	--- ---	6	--- ---	--- ---	20	80	100
AC-312	Applied Organic Practical –I	--- ---	6	--- ---	--- ---	20	80	100

Total Marks for Semester-III 600

*Distribution of teaching hours/week: - Theory – 16 hours, Practical – 12 hours

Total hours – 28 hr

SEMESTER IV

Course No	Title	Hours per week		Examination/Evaluation of marks				
				Theory		Practical		Total
		L	P	Internal	Final	Internal	Final	
AC-401	Applied Inorganic Chemistry-II	4	---	20	80	---	---	100
AC-402	Applied Organic Chemistry-II	4	---	20	80	---	---	100
AC-403	Advanced Organic Chemistry-II	4	---	20	80	---	---	100
AC-404	Applied Analytical Chemistry-II	4	---	20	80	---	---	100
AC-411	Applied Inorganic Practical-II	---	4	---	---	10	60	70
AC-412	Applied Organic Practical –II	---	4	---	---	10	60	70
AC-413	Dissertation & Viva Voce	---	4	---	---	10	50	60

Total Marks for Semester-IV 600

*Distribution of teaching hours/week: - Theory – 16 hours, Practical – 08 hours, and Dissertation & Viva Voce - 04

Total hours – 28 hr

SEMESTER WISE THEORY AND PRACTICAL COURSE

M. Sc. Part- I Applied Chemistry

Semester-I

Paper No. AC 101: Inorganic Chemistry - I

Paper No. AC 102: Organic Chemistry - I

Paper No. AC 103: Physical Chemistry - I

Paper No. AC 104: Analytical Chemistry- I

Practical:

I AC 111

II AC 112

M. Sc. Part- I Applied Chemistry

Semester-II

Paper No. AC 201: Inorganic Chemistry- II

Paper No. AC 202: Organic Chemistry - II

Paper No. AC 203: Physical Chemistry- II

Paper No. AC 204: Analytical Chemistry- II

Practical:

I AC 211

II AC 212

Theory Syllabus and Practical Syllabus is common with General Chemistry M. Sc. Part- I Semester- I & II.

M. Sc. Part- II Applied Chemistry

Semester-III

Paper No. AC 301: Applied Inorganic Chemistry- I

Paper No. AC 302: Applied Organic Chemistry - I

Paper No. AC 303: Applied Physical Chemistry- I

Paper No. AC 304A: Applied Analytical Chemistry- I

Paper No. AC 304B: Pollution Monitoring and Control –I

Paper No. AC 304C: Advanced Organic Chemistry-I

Practical:

I AC 311 (Inorganic & Analytical)

II AC 312 (Organic & Physical)

Semester-IV

Paper No. AC 401: Applied Inorganic Chemistry- II

Paper No. AC 402: Applied Organic Chemistry - II

Paper No. AC 403: Advanced Organic Chemistry-II

Paper No. AC 404A: Applied Analytical Chemistry- II

Paper No. AC 404B: Pollution Monitoring and Control –II

Paper No. AC-404C: Inorganic Chemical Industries-II

Practical:

I AC 411 (Inorganic & Analytical)

II AC 412 (Organic & Analytical)

SHIVAJI UNIVERSITY KOLHAPUR

DEPARTMENT OF APPLIED CHEMISTRY

Implementation of the Credit system with effect from June 2008

Credits as defined is the workload of a student in

1. Lectures
2. Practicals
3. Seminars
4. Private work in the Library/home
5. Examination
6. Other assessment activities

How much time a student gives for the examination per semester?

1) 4 Theory papers per semester each of the three hour duration. Time required is 12 hours
2) 2 Practical papers with 2 experiments per paper. Total 4 practical each of 3 hour duration. Time is required is 12 hour.

Total time for a semester examination is 12 + 12 = 24 hrs

Time required for the **other activities**.

Seminars-as per the requirement of the course

Library- book issue, Journal reference, internet access. Reading magazines and relevant information

Private work – project material, book purchase, Xerox, availing outside facilities etc

Home- Study, notes preparations, computations etc

Types of Credits

1) Credits by examination- test(theory and practical) Seminars
2) Credits by non examination- Proficiency in the state , national and international sports achievements
3) Social service (NSS) Military service (NCC) Colloquium & debate, Cultural programs, creative writting etc

Credits by lectures and practicals

- 1 credit is equivalent to 15 contact hours
- Total instructional days as per the UGC norms are 180.
- For the M Sc course there are 4 theory papers with 4 hours teaching per week

Therefore the instructional days for the theory papers in a semester are 4 x 15(weeks)= 60

- There are 4 practicals (with 1 project) each of 3 hour duration for the 2 practical papers

  Total practical workload is 12 hours. Thus instructional days for the practical course of 4 practicals are 4 (practical papers) x 15 = 60

The time for each student is busy in a semester is 60(Theory) + 60 (Practical) = 120 days

- With 4 credits per subject there will be 4x4=16 credits for the theory papers and 4 x 2=8

  Credits for practicals- Every practical (project) of 50 marks carries 2 credits. Number of credits for M Sc course per semester will be 16 + 8 = 24. Total no credits for entire M Sc course will be 4 x 24 = 96 Credits

How to restructure the M.Sc course implementation of the credit system?

There will not be a major change in the restructured course. However some minor modification can be made in the syllabus wherever necessary.

In order to implement the credit system effectively it is necessary to make every semester duration of at least 15 weeks.

The examination must be scheduled in one months time

The students must get at least 3 weeks time for the examinations preparations.

Every theory papers syllabus should consists of 4 units (sub units allowed) each carrying 1 credit.

In order to have uniformity in the credit transfer it is necessary to have internal examination in all the P.G. departments of equal weightage .80 external +20 internal appears to be ideal to begin with.

Theory paper	contact hours	credits
Unit-1 (sub units if any)	15	1
Unit-2(sub units if any)	15	1
Unit-3 (sub units if any)	15	1
Unit-4(sub units if any)	15	1

The practical course credit distribution

Practical paper	Practical	Contact hours	Credits	No of practicals
I (Unit-1)	1	3	2	6
I (Unit-1)	2	3	2	6
II (Unit-1)	3	3	2	6
II (Unit-1)	4	3	2	6

A project of 50 marks will be carrying 2 credits. Where a project of 50 marks is offered to he student, the student will have to perform 1 project, 1 practical paper (3 practical) for that semester. Time for the explanation for the practical course (contact ours) will be 1 week (12 hours)

This makes the practical workload of the student equal to 60 days in a semester.

Grades, grade point and average grade point's calculations

Table showing the grades, grade points and marks scored by a student

Grades	**Grade points**	**marks out of 100**
A^+	9	91 to 100
A	8	81 to 90
A^-	7	71 to 80
B^+	6	61 to 50
B	5	51 to 60
B^-	4	41 to 50
C^+	3	31 to 40
C	2	21 to 30
C^-	1	11 to 20
F	0	0 to 10

Seminar grade point average SGPA):- It is a semester index grade of a student

1. SGPA = $(g_1xc_1) + (g_2xc_2) +$ -------- $+ (g_6xc_6)$/ Total credits offered by a student in a semester.
2. Cumulative grade point average (CGPA):- It is cumulative index grae point average of student

CGPA = $(g_1xc_1) + (g_2xc_2) +$ -------- $+ (g_6xc_6)$/Total no of credits offered by students up to and including semester for which the cumulative average is required.

3. Final grade point average (FGPA)- It is a final index of student in the course FGPA=$(n/\sum c_i x g_i)/(n/cl)$

Where c1- crdit of the course (paper) (4)

g_i – grade point secured (see the table for conversion)

n- No of courses (no of paper offered)

cl- Total no credits for the entire M Sc course (96)

Illustration with a hypothetical case

For M Sc I (or II/III/IV)

1 papers	I	II	III	IV	Practicals	I	II	III	IV
2 credits	4	4	4	4		2	2	2	2 = 24
3 grade point Obtained	7	6	8	6		7		7	= 41
4 $\sum c_i x gi$	28	24	32	32		28		28	= 164
5 $\sum c_i x gi/sl$	=164/24 = 6.83								
6 Overall grade = 6.83									

The cumulative grade point average is the sum of SGPA of student of every semester. Suppose it is 164(6.83) for semester I, 170(7.08) fro semester II 168 (7.0) for semester III and 176 (7.33) fro semester IV.

The cumulative average for semester I and II will be

Department of Applied Chemistry

M. Sc. course in Applied Chemistry

[Under the Semester System, Academic flexibility & Credit scheme with effect from June: 2008, admission]

SYLLABUS AND SCHEME OF EXAMINATION

SEMESTER I

M. Sc. Part I- APPLIED CHEMISTRY

AC – 101: INORGANIC CHEMISTRY – I **60 h**

Unit-I Wave Mechanics **15 h**

Origin of quantum theory, black body radiation, atomic spectra, photoelectric effect, matter waves, wave nature of the electron, the wave equation, the theory of hydrogen atom, particle in one dimensional box, transformation of coordinates, Separation of variables and their significance.

Unit –II Stereochemistry and Bonding in Main Group Compounds **15 h**

VSEPR theory &drawbacks, Pπ– Pπ, Pπ–dπ and dπ– dπ bonds, Bent rule, Hybridization involving f-orbital energies of hybridization, some simple reactions of covalently bonded molecules.

Unit-III **15 h**

a) Chemistry of Transition Elements 10h

General characteristic properties of transition elements, co-ordination chemistry of transition metal ions, stereochemistry of coordination compounds, ligand field theory, splitting of d orbitals in low symmetry environments, Jahn- Teller effect, Interpretation of electronic spectra including charge transfer spectra, spectrochemical series, nephelauxetic series, metal clusters, sandwich compounds, metal carbonyls

b) Bioinorganic Chemistry 05h

Role of metal ions in biological processes, structure and properties of metalloproteins in electron transport processes, cytochromes, ferrodoxins and iorn sulphur proteins, ion transport across membranes, Biological nitrogen fixation, PS-I, PS – II, Oxygen uptake proteins.

Unit-IV

Electronic, Electric and Optical Behavior of Inorganic Materials 15 h

Metals, Insulators and Semiconductors, Electronic structure of solid, band theory, band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping of semiconductors and conduction mechanism, the band gap, temperature dependence of conductivity, carrier density and carrier mobility in semiconductors, synthesis and purification of semiconducting materials, single crystal growth, zone refining, fractional crystallization, semiconductor devices, rectifier transistors, optical devices, photoconductors, photovoltaic cells, solar batteries.

Recommended Books:

1) A. F. Wells, Structural Inorganic Chemistry – 5th edition (1984)
2) J H Huheey, Inorganic Chemisry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York (1972)
3) J. D. Lee, Concise Inorganic Chemistry, Elbs with Chapman and Hall, London
4) A. R. West, Plenum, Solid State Chemistry and its applications
5) N. B. Hanney, Solid State Physics
6) H. V. Keer, Principles of Solid State
7) S. O. Pillai, Solid State Physics
8) W. D. Callister, Wiley, Material Science and Engineering: An Introduction
9) R. Raghwan, First Course in Material Science
10) R. W. Cahan, The coming of Material Science
11) A. R. West, Basic Solid State Chemistry, 2nd edition
12) U. Schubest and N. Husing, Synthesis of Inorganic Materials, Wiley VCH (2000)
13) M. C. Day and J. Selbin, Theoretical Inorganic Chemistry, Reinhold, EWAP
14) A. H. Hanney, Solid State Chemistry, A. H. Publications
15) O. A. Phiops, Metals and Metabolism
16) Cullen Dolphin and James, Biological aspects of Inorganic Chemistry
17) Williams, An Introduction to Bioinorganic Chemistry
18) M. N. Hughes, Inorganic Chemistry of Biological Processes
19) Ochi, Bioinorganic Chemistry
20) John Wulff, The structure an properties of materials
21) L. V. Azoroff, J. J. Brophy, Electronic processes in materials, Mc Craw Hill
22) F. A. Cotton, R. G. Wilkinson. Advanced Inorganic chemistry
23) Willam L. Jooly, Modern Inorganic Chemistry
24) Manas Chanda, Atomic Structure and Chemical bonding
25) N. N. Greenwood and A. Earnshaw, Chemistry of elements,. Pergamon
26) Chakraburty, Soild State Chemistry, New Age International

27) S. J. Lippard, J.M . Berg, Principles of bioinorganic Chemistry, University Science Books
28) G. L. Eichhron, Inorganic Biochemistry, Vol I and II, Elesevier
29) Progress in Inorganic chemistry , Vol 18 and 38, J. J. Loppard, Wiley

AC-102: ORGANIC CHEMISTRY-1 **60 h**

Unit-I **15 h**

a) Reaction Mechanism: Structure and Reactivity 08h

Types of reactions, potential energy diagrams, transition states and intermediates. Hard and soft acids and bases, strength of acids and bases. Generation, structure, stability and reactivity of carbocations and carbanions.

b) Aliphatic Nucleophilic Substitutions: 07h

The SN2, SN1 and Sni reactions with respects to mechanism and stereochemistry. Nucleophilic substitutions at an allylic, aliphatic trigonal and vinylic carbons. Reactivity effect of substrate structure, effect of attacking nucleophiles, leaving groups and reaction medium. Ambident nucleophiles, Neighbouring Group Participation.

Unit-II **15 h**

a) Aromatic Electrophilic Substitutions: 08h

Introduction, Concept of Aromaticity, the arenium ion mechanism, orientation and reactivity in Nitration, Sulphonation, Friedel-Crafts and Halogenation in aromatic systems, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in their ring systems. Diazo-coupling, Vilsmeir reaction, Gatterman-Koch rection, Von Richter rearrangement . Nucleophilic aromatic substitution reactions SN1, SN2.

Unit-III **15 h**

a)Addition to Carbon–Carbon Multiple Bonds 07h

Mechanism and steriochemical aspects of the addition reactions involving electrophiles and free radicals, regio and chemo-selectivity, orientation and reactivity. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Michael reaction.

b) Elimination Reactions: 08h

The E1, E2 and E1cB mechanisms. Orientation in Elimination reactions. Reactivity: effects of substrate structures, attacking base the leaving group the nature of medium on elimination reactions. Pyrolytic elimination reactions.

Unit-IV **15 h**

a) Study of Following Reactions: 07h

Beckman, Fries, Benzilic acid, Hoffman, Schmidt, Curtius, Lossen & Benzilic acid, Witting, Neber, and Prins.

b) Stereochemistry: 08h

Concept of Chirality and molecular dissymmetry, Recognition of symmetry elements and chiral centers, Prochiral relationship, homotopic, enantiotopic and disteriotopic groups and faces. Recemic modifications and their resolution, R and S nomenclature. Geometrical isomerism E and Z. Nomenclature. Conformational analysis : cyclohexane derivatives, stability and reactivity, Conformational analysis of disubstituted cyclohexanes.

References:

1. A guide book to mechanism in Organic chemistry (Orient-Longmens)- Peter Sykes
2. Organic reaction mechanism (Benjamin) R. Breslow
3. Mechanism and structure in Organic chemistry (Holt Reinh.)B. S. Gould.
4. Organic chemistry(McGraw-Hill)Hendrikson, Cram and Hammond.
5. Basic principles of Organic chemistry (Benjamin) J. D.Roberts and M. C. Caserio.
6. Reactive Intermediates in Organic chemistry (John Wiley)N. S. Issacs.
7. Stereochemistry of Carbon compounds. (McGraw-Hill)E.L.Eliel
8. Organic Stereochemistry (McGraw-Hill) by Hallas.
9. Organic reaction mechanism (McGraw-Hill) R. K. Bansal.
10. Organic chemistry- R. T. Morrison and R. N. Boyd,(Prentice Hall.)
11. Modern organic reactions(Benjumin) H. O. House.
12. Principle of organic synthesis- R.O.C. Norman and J. M. Coxon.(ELBS)
13. Reaction mechanism in organic chemistry- S. M. Mukharji and S. P. Singh.
14. Stereochemistry of organic compoundsc) D. Nasipuri.
15. Advanced organic chemistry (McGraw-Hill) J. March.
16. Introduction to stereochemistry(Benjumin) K. Mislow.
17. Stereochemistry by P. S. Kalsi (New Age International)

AC-103: PHYSICAL CHEMISTRY – I **60 h**

Unit-I **15 h**

Thermodynamics-I 03h

1. Introduction, revision of basic concepts.
2. Second law of thermodynamics: Physical significance of entropy (Direction of spontaneous change and dispersal of energy), Carnot cycle, efficiency of heat engine, coefficient of performance of heat engine, refrigeration and problems. 06h
3. Maxwell relations, thermodynamic equation of state, chemical potential, variation of chemical potential with temperature & pressure. Applications of chemical potential, phase rule, lowering of vapor pressure (Rault's law) and elevation in boiling point. 06h

Unit-II **15 h**

Thermodynamics-II

1. Ideal solutions, Rault's law, Duhem-Margules equation and its applications to vaporpressure curves (Binary liquid mixture), determination of activity coefficients fromvapor pressure measurements, Henry's law. 08h
2. Nonideal solutions : deviations from ideal behaviour of liquid mixtures, liquid-vapor compositions, conditions for maximum. 07h

Unit-III **15 h**

Kinetic Theory of Gasses

1. Postulates of kinetic theory of gases, P-V-T relations for an ideal gas, non-ideal behavior of gases, equation of state, compressibility factor, virial equation, van der Waal's equation, excluded volume and molecular diameter, relations of van der Waal's constants with virial coefficients and Boyle temperature. 05h
2. Molecular statistics, distribution of molecular states, deviations of Boltzmann law for molecular distribution, translational partition function, Maxwell-Boltzmann law for distribution of molecular velocities, physical significance of the distribution law, deviation of expressions for average, root mean square and most probable velocities, experimental verification of the distribution law. 05h
3. Molecular collision in gases, mean free path, collision diameter and collision number in a gas and in a mixture of gases, kinetic theory of viscosity and diffusion. 05h

Unit-IV **15 h**

Colloids and Macromolecules

1. Sols, Lyophilic and lyophobic sols, properties of sols, coagulation. Sols of surface active reagents, surface tension and surfactants, critical micelle concentration. 05h

2. Macromolecules: Mechanism of polymerization, molecular weight of a polymer (Number and mass average) viscosity average molecular weight, numerical problems. Degree of polymerization and molecular weight, methods of determining molecular 05h

Weights (Osmometry, viscometry, light scattering, diffusion and ultracentrifugation) 05h

3. Chemistry of polymerization: Free radical polymerization(Initiation, propagation and termination), kinetics of free radical polymerization, step growth polymerization(Polycondensation), kinetics of step polymerization, cationic and anionic polymerization. 05h

(More stress should be given to solving numerical problems)

References:

1. Physical Chemistry – P. W. Atkins, Oxford University press, VIIth edition,2002.
2. Text book of Physical Chemistry – S. Glasstone
3. Principles of Physical Chemistry – Marron and Pruton
4. Physical Chemistry – G. M. Barrow, Tata-McGraw Hill, Vth edition, 2003.
5. Physical chemistry- G. K. Vemulapalli, Prentice-Hall of India, 1997.
5. Thermodynamics for Chemists – S. Glasstone, D. Van Nostrand , 1965.
6. Thermodynamics A Core Course- R. C. Srivastava, S. K. Saha and A. K. Jain, Prentice-Hall of India, IInd edition, 2004.
7. Physical Chemistry of macromolecules- D. D. Deshpande, Vishal Publications.
8. Polymer Chemistry- F. W. Billmeyer Jr, John-Wiley & Sons, 1971.

AC-104 ANALYTICAL CHEMISTRY –I **60 h**

Unit-I

Errors and Treatment of Analytical Chemistry **15 h**

Errors, Determinant, constant and indeterminate. Accuracy and precision Distribution of random errors. Average derivation and standard derivation, variance and confidance limit. Significance figures and computation rules. Least square method. Methods of sampling: samples size. Techniques of sampling of gases, fluid, solids, and particulates.

Unit-II

Chromatographic Methods: **15 h**

General principle, classification of chromatographic methods. Nature of partition forces. Chromatographic behavior of solutes. Column efficiency and resolution.
Gas Chromatography: detector, optimization of experimental conditions. Ion exchanges chromatography. Thin layer chromatography: coating of materials, prepative TLC. Solvents used and methods of detection Column chromatography: Adsorption and partition methods. Nature of column materials.
Preparation of the column. Solvent systems and detection methods.

Unit-III **15 h**

Electroanalytical Techniques:

Polarography: Introduction, Instrumentation, Ilkovic equation and its verification. Derivation of wave equation, Determination of half wave potential, qualitative and quantitative applications. Amperometry: Basic principals, instrumentation, nature of titration curves, and analytical applications.

Unit-IV **15 h**

Computer Science:

Introduction: History etc. Hardware: Central processor unit. Input devices. Storage devices. Periferals, Software: Overview of the key elements of basic program structure, loops, arrays, mathematical function. User defined functions, conditional statements, string. Applications. Data representation, Computerized instruments system. Microcomputer interfacing

References:

1. Analytical Chemistry: (J.W) G. D. Christain
2. Introduction to chromatography : Bobbit

3. Instrumental Methods of analysis (CBS)- H.H . Willard, L.L. Mirrit, J.A. Dean
4. Instrumental Methods of Analysis : Chatwal and Anand
5. Instrumental Methods of Inorganic Analysis(ELBS) : A.I. Vogel
6. Chemical Instrumentation: A Systematic approch- H.A. Strobel
7. The principals of ion-selective electrodes and membrane transport: W.E.Morf
8. Physical Chemistry – P.W.Atkins
9. Principal of Instrumental Analysis- D. Skoog and D.West
10. Treatise on Analytical Chemistry: Vol Ito VII – I.M. Kolthoff
11. Computer, Fundamentals-P.K.Sinha
12. Programming in BASIC : E. Balaguruswamy
13. Computer programming made simples : J.Maynard.

M. Sc. Part I Semester-I
Inorganic Chemistry Practical Course
Practical No. AC-111 and AC-112

1. Ore analysis – '2' ores
2. Alloy analysis – '2' (Two and three components)
3. Inorganic Preparations and purity – '4'

References:

1) A text book of Quantitative Inorganic Analysis – A. I. Vogel
2) Experimental Inorganic Chemistry - W. G. Palmer
3) The analysis of minerals and ores of the rarer elements – W. R. Schoeller and A.R. Powell, Charles, Griffin and Company Limited

M. Sc. I – Semester I
Organic Chemistry Practicals

A) Preparations

(One stage preparations involving various types of reactions)

1.Oxidation: Adipic acid by chromic acid oxidation of Cyclohexanol.
2.Aldol condensation: Dibenzal acetone from Benzaldehyde.
3.Sandmeyer reaction: p- Chlorotoulene from p-Toluidine.
4.Cannizzaro reaction: 4-chlorobenzyldehyde as a substrate.
5.Aromatic Electrophilic substitutions: Synthesis of p-Nitroaniline and p-Bromoaniline.
6.Preparation of Cinnamic acid by Perkin's reaction.
7.Knoevenagel condensation reaction
8.Coumarin Synthesis
9.Synthesis of Heterocyclic compounds.
10. Synthesis of Dyes

B)Estimations:

1.Estimation of unsaturation.
2.Estimation of formalin.

3.Colorimetric Estimation of Dyes
4.Estimation of Amino acids
(Any suitable Expt. may be added.)

Reference books

1.A text book of practical organic chemistry- A. I. Vogel.
2.Practical organic chemistry- Mann and Saunders.
3.A handbook of quantitative and qualitative analysis- H. T. Clarke.
4.Organic Synthesis Collective Volumes by Blat.

M. Sc. Part I Semester-I
Physical Chemistry Practicals

Students are expected to perform 15-20 experiments of three and half hours duration.
Experiments are to be set up in the following techniques.
1. Potentiometry:
Determination of solubility and solubility product of silver halides, determination of binary mixture of weak and strong acid etc.
2. Conductometry :
Determination of mixture of acids and relative strength of weak acids.
3 Refractometry :
Determination of molecular radius of molecule of organic compound.
4 Polarimetry :
Kinetics of inversion of cane sugar in presence of strong acid.
5 Chemical Kinetics :
Kinetics of reaction between bromate and iodide.
6 Partial Molar Volume :
Determination of PMV by intercept method, density measurements etc.
(New experiments may also be added)

Books recommended for Practicals :

1 Findlay's Practical Chemistry – Revised by J.A. Kitchner (Vedition)
2 Text Book of Quantitative inorganic analysis : A.I. Vogel.
3 Experimental Physical Chemistry : R.C.Das and B. Behera
4 Practical Physical Chemistry : B. Viswanathan and P.S. Raghavan
5 Experimental Physical Chemistry :V.D. Athawale and Parul Mathur.
6 Systematic Experimental Physical Chemistry :S.W. Rajbhoj and T.K. Chondhekar

M. Sc. Part-I Semester-I
Practicals in Analytical Chemistry.

Physical Analytical Chemistry Section

1) To verify Beer-Lambert's Law for potassium permanganate solution and hence to
determine the molar extinction coefficient and unknown concentration of given sample colorimetrically

2) To determine the solubility of calcium oxalate in presence of KCl (Ionic Strength
Effect)

3) To determine the solubility of calciuum oxalate in presence of HCl (H+ ion Effect)

(Any other experiments may be added)

Organic Analytical Chemistry Section

1 Analysis of Pharmaceutical tablets.

2 To verify the Beer-Lamberts Law and determine the concentration of given dye solution colorimetrically.

3 To estimate the amount of D-glucose in given solution colorimetrically.

4 To determine the acid value of given oil

(Any other experiments may be added)

Inorganic Analytical Chemistry Section

1 Determination of sodium from the fertilizer sample using cation exchange chromatographically.

2 Determination of calcium from given drug sample.

3 Determination of hardness, alkalinity and salinity of water sample

4 Separation and estimation of chloride and bromide on anion exchanger.

(Any other experiments may be added)

SEMESTER II

M. Sc. Part I- APPLIED CHEMISTRY

AC 201: INORGANIC CHEMISTRY – II **60 h**

Unit-I Chemistry of Non – Transition Elements **15 h**

General discussion on the properties of the non – transition elements, special features of individual elements, synthesis, properties and structure of halides and oxides of the non – transition elements, Polymorphism in carbon, phosphorous and sulphur, Synthesis, properties and structure of boranes, carboranes, silicates, carbides, phosphazenes, sulphur – nitrogen compounds, peroxo compounds of boron, carbon,sulphur, structure and bonding in oxyacids of nitrogen, phosphorous, sulphur and halogens, interhalogens, pseudohalides.

Unit-II **15 h**

a) Organometallic Chemistry of Transition Elements 08 h

Ligand hapticity, electron count for different types of organometallic compounds, 18 and 16 electron rule exceptions, synthesis, structure and bonding, organometallic reagents in organic synthesis and in homogeneous catalytic reactions (Hydrogenation, hydroformylation, isomerisation and polymerisation), pi metal complexes, activation of small molecules by coordination

b) Metal – Ligand Equilibria in Solution 07 h

Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of formation constants by pH – metry, spectrophotometry methods.

Unit-III **15 h**

Studies and Applications of Lanthanides and Actinides
Spectral and magnetic properties, use of lanthanide compounds as shift reagents, Modern methods of separation of lanthanides and actinides, Organometallic chemistry applications of lanthanide and actinide compounds in Industries.

Unit-IV **15 h**

a) Chemistry in Non- Aqueous Solvents 07 h

Classification of solvents, properties, leveling effect, type reactions in solvents, chemistry of liquid ammonia, liquid dinitrogen tetraoxide and anhydrous sulphuric acid with respect to properties, solubilities and reactions.

b) Nuclear and Radiochemistry 8 h

Radioactive decay and equilibrium, nuclear reactions, Q value, cross-sections, types of reactions, chemical effects of nuclear transformation, fission and fusion, fission products and fission yield

References:

1) A. F. Wells, Structural Inorganic Chemistry – 5th edition (1984)
2) J H Huheey, Inorganic Chemistry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York (1972)
3) J. D. Lee, Concise inorganic Chemistry, Elbs with Chapman and Hall, London
4) M. C. Day and J. Selbin, Theoretical Inorganic Chemistry, Reinhold, EWAP
5) Jones , Elementary coordination Chemistry
6) Martell, Coordination Chemistry
7) T. S. Swain and D. S. T. Black, organometallic Chemistry
8) John Wulff, structure and properties of materials, vol – 4, electronic properties, Wiley Eastern
9) L. V. Azoroff, J. J. Brophy, Electronic processes in materials, Mc Craw Hill
10) F. A. Cotton, R. G. Wilkinson. Advanced Inorganic chemistry
11) Willam L. Jooly, Modern Inorganic Chemistry
12) Manas Chanda, Atomic Structure and Chemical bonding
13) P. L. Pauson, Organometallic Chemistry
14) H. S. Sisler, Chemistry in non – aqueous solvents, Reinhold Publishing Corporation, USA, 4th edition (1965)
15) H. J. Arnikar, Essentials of Nclear Chemistry
16) Friedlander, Kennedy and Miller, Nuclear and Radiochemistry

AC-202: ORGANIC CHEMISTRY-II **60 h**

Unit-I Study of Following Reactions: **15 h**

Mechanism of condensation reaction involving enolates Mannich, Benzoin, Stobbe, Dieckmann, Diels-Alder, Robinson annulation Reimer-Tieman, Chichibabin, Baeyer Villiger oxidation

Unit-II **15 h**

a) Alkylation and Acylation
Introduction, Types of alkylation and alkylating agents: C-Alkylation and Acylation of active methylene compounds and Applications 08h
b)Hrdroboration and Enamines : Mechanism and Synthetic Applications**.** 07h

Unit-III **15 h**

a) Reductions: 08h
Study of following reductions- Catalytic hydrogenation using homogeneous and heterogeneous catalysts. Study of following reactions: Wolff-Kishner, Birch, Clemmensen, Sodium borohydride, Lithium Aluminium hydride (LAH) and Sodium in alcohol, Fe in HCl.
b) Oxidation : 07h
Application of following oxidizing agents: KMnO4, chromium trioxide, Manganese dioxide, Osmium tetraoxide, DDQ, Chloranil .

Unit-IV **15 h**

a) Study of Organometallic Compounds: 08h
Organo-magnesium, Organo-zinc and Organo-lithium, Hg and Sn reagents; Use of lithium dialkyl cuprate their addition to carbonyl and unsaturated carbonyl compounds.
b) Methodologies in Organic Synthesis -ideas of synthones and retrones. Functional group transformations and interconversions of simple functionalities. 07h

Recommended books

1.Modern synthetic reactions-(Benjamin) H. O. House.
2.Reagents in organic synthesis-(John Wiley) Fieser and Fieser
3.Principles of organic synthesis-(Methuen) R. O. C. Norman
4.Hydroboration- S. C. Brown.

5.Advances in Organometallic Chemistry- (A.P.)F. C. A. Stone and R. West.
6.Organic Chemistry (Longman)Vol. I & Vol. II- Finar
7.Oxidation by-(Marcel Dekker) Augustin
8.Advanced Organic chemistry 2nd Ed. R R. Carey and R. J. Sundburg.
9.Tetrahydron reports in organic chemistry- Vol.1, No. 8.
10.Organic Synthesis-(Prentice Hall)R. E. Ireland.
11.Homogeneous Hydrogenation-(J. K.) B. R. James.
12.Comprehensive Organic Chemistry- (Pargamon) Barton and Ollis.
13.Organic reactions- various volumes- R. Adams.
14.Some modern methods of Organic synthesis-(Cambridge) W. Carruthares.

AC-203: PHYSICAL CHEMISTRY – II **60 h**

Unit-I Photochemistry **15 h**

Absorption of light and nature of electronic spectra, electronic transition, Frank-Condon principle, selection rules, photodissociation, predissociation, photochemical reactions: photoreduction, photooxidation, photodimerization, photochemical substitution, photoisomerization, photochemistry of environment: Green house effect.

Unit-II Photo Physical Phenomena **15 h**

Electronic structure of molecules, molecular orbital, electronically excited singlet states, designation based on multiplicity rule, life time of electronically excited state, construction of Jablonski diagram, electronic transitions and intensity of absorption bands, photphysical pathways of excited molecular system(radiative and non-radiative), prompt fluorescence, delayed fluorescence, and phosphorescence, fluorescence quenching: concentration quenching, quenching by excimer and exciplex emission, fluorescence resonance enrgy transfer between photexcited donor and acceptor systems. Stern-Volmer relation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisional V quenching and Stern-Volmer equation.

Unit-III Electrochemistry **15 h**

1.Arrhenius theory of electrolytic dissociation (Evidences and limitations), revision of basic electrochemistry(Types of electrodes and cells). 03h
2. Electrochemical cells with and without transference, determination of activity coefficients of an electrolyte, degree of dissociation of monobasic weak acid (approximate and accurate), instability constant of silver ammonia complex. 10h
3. Acid and alkaline storage batteries. 02h

Unit-IV Chemical Kinetics **15 h**

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 and study of reaction between NO2 and F2, decomposition of ozone, and nitrogen pentoxide. 08h
2. Kinetics of complex reactions, Simultaneous (first order opposed by first order), Parallel and Consecutive reactions. Examples and numericals. 07h

References:

1. Photochemistry – J. G. Calverts and J. N. Pitts, John-Wiley & Sons
2. Fundamentals of Photochemistry- K. K. Rohatgi-Mukharjii, Wiley Eastern
3. Introduction to Photochemistry-Wells
4. Photochemistry of solutions-C. A. Parker, Elsevier
5. Chemical Kinetics-K. J. Laidler, pearson Education,2004
6. Electrochemistry- S. Glasstone, D. Van Nostrand , 1965
7. Advanced Physical Chemistry- Gurdeep Raj, Goel Publishing House
8. Basic chemical Kinetics- G. L. Agarwal, Tata-McGraw Hill
9. Physical Chemistry – P. W. Atkins, Oxford University press, VIIth edition,2002.
10. Physical Chemistry – G. M. Barrow, Tata-McGraw Hill, Vth edition, 2003.

AC-204 ANALYTICAL CHEMISTRY- II **60 h**

Unit-I **15 h**

a) Ultraviolet and Visible Spectrophotometry (UV-VIS) 08h
Introduction, Beer Lambert's law, instrumentation, calculation of absorption maxima of dienes, dienones and polyenes, applications.

b) Infrared Spectroscopy (IR) 07h
Introduction, instrumentation, sampling technique, selection rules, types of bonds, absorption of common functional groups. Factors affecting frequencies, applications.

Unit-II **15 h**

a) Nuclear Magnetic Resonance (NMR) 08h
Magnetic and non magnetic nuclei, Larmor frequency, absorption of radio frequency. Instrumentation (FT-NMR). Sample preparation, chemical shift, anisotropic effect, spinspin coupling, coupling constant, applications to simple structural problems

b) Mass Spectroscopy (MS) 07h
Principle, working of mass spectrometer (double beam). Formation of different types of ions, Mclafferty rearrangements, fragmentation of alkanes, alkyl aromatics, alcohols and ketones, simple applications, simple structural problems based on IR, UV , NMR and MS

Unit-III **15 h**

a) Nephelometry and Turbidometry 07h
Introduction, Theory, Instruments, working and Applications

b) Radiochemical Analysis, NAA: Scintillation counter and G.M. Counter 08h

Unit-IV **15 h**

a) Atomic Absorption Spectroscopy 10h
Introduction, Principal, difference between AAS and FES, Advantages of AAS over FES, advantages and disadvantages of AAS. Instrumentation, Single and double beam AAS, detection limit and sensitivity, Interferences applications.

b) Inductively Coupled Plasma Spectroscopy 05h

Introduction, Nebulisation Torch, Plasmsa, Instrumentation, Interferences, Applications

References:

1. Instrumental Methods of analysis- Willard, Merrit, Dean and Settle.
2. Spectroscopic identification of organic compounds- R.M. Silverstein and G.C. Bassler
3. Spectroscopic methods in organic chemistry- D.H. Williams and I. Fleming
4. Absorption spectroscopy of organic molecules- V.M. Parikh
5. Applications of spectroscopic techniques in Organic chemistry- P.S. Kalsi
6. A Text book of Qualitative Inorganic Analysis- A. I. Vogel
7. Physical Methods in Inorganic Chemistry (DWAP)- R. Drago
8. Fundamentals of Analytical Chemistry – D.A. Skoog and D.M. West (Holt Rinehart and Winston Inc)

M. Sc. Part – I Semester - II
Practical No. AC- 211 and AC-212

Inorganic Chemistry Practical Course

1. Ore analysis – '2' ores
2. Alloy analysis – '2' (Two and three components)
3. Inorganic Preparations and purity – '4'

References:

1) A text book of Quantitative Inorganic Analysis – A. I. Vogel
2) Experimental Inorganic Chemistry - W. G. Palmer
3) The analysis of minerals and ores of the rarer elements – W. R. Schoeller and A. R. Powell, Charles, Griffin and Company Limited

M. Sc. Part – I Semester - II
Organic Chemistry Practicles

1.Qualitative analysis:
Separation and identification of the two component mixtures using Chemical and physical methods.
2.Thin layer chromatography (TLC).
3.Column chromatography and steam distillation techniques.
4.Determination of percentage of Keto-enol form.
5.Estimation of pesticides
(Any other suitable experiments may be added).

References:

1.A text book of practical organic chemistry- A. I. Vogel.
2.Practical organic chemistry- Mann and Saunders.
3.A handbook of quantitative and qualitative analysis- H. T. Clarke.
4.Organic Synthesis Collective Volumes by Blat.

M. Sc Part-I – Semester II
Physical Chemistry Practicals

Students are expected to perform 15-20 experiments of three and half-hours duration.
Experiments are to be set up in the following techniques.
1 Potentiometery:
Determination formal redox potential of system, determination of binary mixture of halides.
2. Conductometry :
Titration of ternary acid mixture of acids, Verification of Onsagar Equation for 1:1 type strong electrolyte.
3 Refractometry :
Determination of atomic refractions of H, C and Cl atoms.
4 Cryoscopy:
Determination of apparent weight and degree of dissociation a strong electrolyte equilibrium methods.
5 Chemical kinetics:
Kinetics of iodination of acetone in presence of strong acid etc.
6 Phase Equilibrium:
Three component system etc.
(New experiments may be also be added)
Books recommended for Practicals :

1. Findlay's Practical Chemistry – Revised by J.A. Kitchner (Vedition)
2. Text Book of Quantitative inorganic analysis : A.I. Vogel.
3. Experimental Physical Chemistry : By F. Daniels and J. Williams
4. Experimental Physical Chemistry : R.C Das and B.Behera
5 Practical Physical Chemistry : B. Viswanathan and P.S. Raghavan

M. Sc. Part-I Semester-II
Practicals in Analytical Chemistry.

Physical Analytical Chemistry Section
1 To estimate the amount of NH4Cl colorimetrically using Nesseler's Reagent.
2 Determine the solubility of lead iodide in presence of varying concentration of salt
KCl.

3 Determine the solubility of lead iodide in presence of varying concentration of salt
KNO3
(Any other experiments may be added)

Organic Analytical Chemistry Section
1 Analysis of pharmaceutical tablets: Ibrufen / INAH
2 Colorimetric estimation of drugs.
3 Preparation of pesticides.
4 Column and thin layer chromatography
(Any other experiments may be added)

Inorganic Analytical Chemistry Section
1 To determine the amount of copper in brass metal alloy colorimetrically.
2 Separation and estimation of Copper and Cobalt on cellulose Column.
3 Separation and estimation of Nickel and Cobalt on a anion exchanger.
4 Separation and estimation of Iron and aluminium on a cation exchanger.
(Any other experiments may be added)

Recommended books
1 A Text book of quantitative Inorganic Analysis – A. I. Vogel
2 Standards methods of Chemical Analysis-F.J. Welcher.
3 Experimental Inorganic Chemistry – W. G. Palmer.
4 Manual on Water and Waste Water Analysis, NEERI- Nagpur D.S. Ramteke and C. A. Moghe
5 Inorganic synthesis- King.
6 Synthetic Inorganic Chemistry-W .L. Jolly
7 EDTA Titrations –F Laschka

SEMESTER III

M. Sc. Part II- APPLIED CHEMISTRY

AC 301 APPLIED INORGANIC CHEMISTRY-I **Total 60 h**

Unit I Spectral and Magnetic Properties of Metal Complexes **15 h**

Spectral properties of complexes: Term symbols for d-ions. Characteristics of d-d transitions. Selection rules for d-d transitions. Orgel diagrams. Tanabe-Sugano diagrams. Effects of Jahn-Teller distortion and spin-orbit coupling on spectra. Charge transfer spectra.

Magnetic properties of metal complexes: Type of magnetism shown by complexes. Magnetic susceptibility measurements. Gouy method. Spin-only value. Orbital contribution to magnetic moment. Ferromagnetism and antiferromagnetism in complexes. Application of magnetic measurements to structure determination of transition metal

Unit II Chemistry of materials, Glasses, Ceramics and Composites **15 h**

Structure of glass, glass formers and glass modifiers. Applications of glass. Ceramic structure, mechanical properties, clay products. Microscopic composites- dispersion strengthened and particle reinforced, fibre reinforced composites, macroscopic composites. Thin films and Langmuir- Blodget Films: Preparation techniques. Langmuir-Blodgett film, growth techniques, properties and applications of thin film. Liquid crystals: Mesomorphic behaviour, thermotropic liquid crystals, nematic and smectic mesophases. Optical and dielectric properties of liquid crystals. Lyotropic phases and their description of ordering. High TC materials: Perovskites. Properties and preparation of 1-2-3 and 2-1-4 materials. Properties dependent of temperature. Application of high TC materials. Organic solids, fullerenes and molecular devices: Conducting organic materials and Fullerenes- preparation and properties. Molecular rectifiers and transistors. Optical storage devices, sensors. Nonlinear optical materials.

Unit III Nanoscience and Nanomaterials **15 h**

Introduction to nanoscience and nanotechnology, Nano and Nature, Experimental methods of investigating and manipulating the materials at the nano scale, Preparation methods of nanomaterils, Characterization techniques for nanomaterials, Applications of nanotechnology and nanomaterials, Nanobiotechnology, Nanosensors, Nanomedicines, Nanophotonics, Implications of nanotechnology, Future fantasy and nanotechnology

Unit IV Electrical and Magnetic Properties of Solids 15 h

Electrical properties of solids: Conductivity of pure metals. Superconductivity. Photoconductivity. Photovoltaic effect. Dielectric properties. Dielectric materials. Ferroelectricity, pyroelecricity and pizoelectricty. Applications of ferro, piezo and pyroelectrics.

Magnetic properties of solids: Behaviour of substances in a magnetic field. Diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism and ferrimagnetism Effect of temperature. Curie and Curie-Weiss laws. Calculation of magnetic moments. Magnetism of ferro and antiferromagnetic ordering. Super exchange. Lasers and their applications. Advanced materials with novel properties and potential applications including solid electrolytes, Mixed ionic/electronic conductors

References;

1. M.C.Day and J.Selbin, "Theoretical Inorganic Chemistry", Affiliated East-West Press
2. F.A.Cotton and G.Wilkinson, "Advanced Inorganic Chemistry", John Wiley & Sons
3. J.E.Huheey, "Inorganic Chemistry -Principles of Structure and Reactivity", Harper & Collins College Publication
4. S.F.A.Kettle, "Coordination Chemistry", Longman
5. J.C.Bailar, "Chemistry of Coordination Compounds", Reinhold
6. F.Baselo and R. Johnson, "Coordination Chemistry", Bejamin Inc.
7. H.J.Emeleus and A.G.Sharp, "Modern Aspects of Inorganic Chemistry", Van Nostrand
8. B.Hannay, "Solid State Chemistry, Prentice Hall.
9. F.C.Phillips, "An Introduction to Crystallography", Longman
10. C.Kittel, "Introduction to Solid State Physics", John Wiley & Sons12.
11. T.Moeller, "The Chemistry of the Lanthanides", Reinhold.
12. G.T.Seaborg. J.J.Katz and W.M.Manning, "The Transuranium Elements", McGraw-Hill
13. G.T.Seaborg, "Manmade Transuranium Elements", Prentice Hall
14. F.A.Cotton (Ed), "Progress in Inorganic Chemistry", Interscience.
15. Simon Cotton, "Lanthanides and Actinides", Macmillan

AC 302 APPLIED ORGANIC CHEMISTRY- I 60 h

Unit I Aromaticity and Symmetry Controlled Reactions 15 h

Symmetry properties of MO'S. LCAO-MO theory of simple conjugated polyenes and cyclic polyenes. Aromaticity and antiaromaticity. Homo, hetero and nonbenzenoid aromatic systems. Aromaticity of annulenes. mesoionic compounds, metallocenes, cyclic carbocations and carbanions. Mechanism and stereo course of electrocyclic, cycloaddition and sigmatropic reactions. FO, CD and Huckel-Mobius analysis of elecrocyclic and cycloaddition reaactions. FO analysis of [i,j] and [3,3] migrations. Claisen rearrangement. Stereoaspects of Diels-Alder reaction and Cope rearrangement. Retro Diels-Alder, Cheletropic and cis elimination reactionsand their Synthetic applications.

Unit-II Pericyclic Reactions 15 h

Molecular orbital symmetry, Frontier orbitals of ethylene 1,3 butadiene, 1,3,5, hexatriene and allyl system, classification of pericyclic reactions, Woodward- Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions- conrotatory and disrotatory motion, 4n, 4n+2 and allyl systems. Cycloadditions – antarafacial and suprafacial addition ,4n and 4n+2 systems, 2+2 addition of ketenes, 1,3, dipolar cycloadditions . Sigmatropic rearrangements- suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3, and 5,5 sigmatropic rearrangements. Ene reaction.

Unit III Organic Photochemistry & Free Radical Reactions 15 h

Photochemical processes. Energy transfer, sensitization and quenching. Singlet and triplet states and their reactivity. Photoreactions of carbonyl compounds, enes, dienes, and arenes. Norrish reactions of acyclic ketones. Patterno-Buchi, Barton, photo-Fries and Di-π-methane rearrangement reactions. Photoreactions of Vitamin D. Photochemistry of vision and photosynthesis. Singlet oxygen generation and reactions. Applications of photoreactions and their applications for industrial synthesis.

Unit IV Molecular Rearrangements 15 h

Mechanism, with evidence, of Wagner – Meerwein, Pinacol, Demjanov, Hofmann, Curtius, Schmidt, Lossen, Beckmann, Wolff, Fries, Arylozo, Fischer-Hepp, Hofmann-Martius, von Richeter, Orton, Bamberger, Smiles, Dienone-Phenol, Benzilic acid, Benzidine, Favorskii, Stevens, Writtig, Sommelet-Hauser, Baeyer-Villiger, Hydroperoxide and borane rearrangements. Dakin reaction

References

1. D.H.Williams and I.Fleming, "Spectroscopic Methods in Organic Chemistry", Wiley.
2. W.Kemp, "Organic Spectroscopy", Longman

3. J.March, “Advanced Organic Chemsitry”, Wiley
4. R.O.C.Norman and A.Coxon, “Modern Synthetic Reactions”, Chapman and Hall
5. M.B.Smith, “Organic Synthesis”, McGraw-Hill
6. R.K.Bansal, “Synthetic Applications in Organic Chemistry”, Narosa
7. R.J.Simmonds, “Chemistry of Biomolecules”, Royal Society of Chemistry I.L.Finar, “Organic Chemistry” Vol2 , Longman
8. R.J.Young, “Introduction to Polymer Science”, John Wiley & Sons
9. F.W.Billmayer, Text Book of Polymer Science”, John Wiley & Sons
10. G.Odian, “Principles of Polymerization”, John Wiley & Sons
11. J.M.G.Cowie, “Polymers: Chemistry and Physics of Modern Materials”, Blackie.
12. K.J.Sauders, “Organic Polymer Chemistry”, Chapman and Hall

AC 303 APPLIED PHYSICAL CHEMISTRY-I **60 h**

Unit I Catalysis- Principles And Applications **15 h**

Basic principles of catalysis: adsorption isotherms, surface area pore size and acid strength measurement. Enthalpy and entropy of adsorption: interpretation of chemisorptions based on the structure and the nature of the solid – solid state theories – role of defects in catalysis. Kinetic of surface reactions: rate determining step, various types of reaction, simple, parallel and consecutive reactions. Selection, preparation and evaluation of catalysts – test reaction, promoters, carriers and stabilizers. Mechanisms of selected reactions: hydrogenation and dehydrogenation reaction – dehydration of alcohols, olefin hydrogenation, decomposition of nitrous oxide, oxidation of CO-etonization of carboxylic acids, cracking of hydrocarbons.
Applications: petrochemical industry – reforming and refining – value added chemicals-environmental protection autoexhaust catalysts Novel catalytic material clusters, zeolites, mesoporous materials.
Electrocatalysis and Photo catalysis: Solid liquid interfaces.
Techniques in catalysis**.**

Catalysis: Mechanism and theories of homogeneous and heterogeneous catalysis. Acid-base and enzyme catalysis. Bimolecular surface reactions. Langmuir-Hinshelwood mechanism.

Unit II Statistical Thermodynamics **15 h**

Statistical thermodynamics: Mechanical description of molecular systems. Termodynamic property and entropy. Microstates. Canonical and grand canonical ensembles. Equation of state of ideal quantum gases. Maxwell-Boltzman distribution. The partition functions. Partition function for free linear motion, for free motion in a shared space, for linear harmonic vibration. Complkex partition functions and partition functions for particles in different force fields. Langevins partition function and its use for the determination of dipole moments. Electrostatic energies. Molecular partition functions. Trnslational, rotational, vibrational and electronic partition functions. Total partition functions. Partition functions ant thermodynamic properties.

Unit III Electrochemistry and Electrodics **15 h**

Ionics: Ions in solution. Deviation from ideal behaviour. Ionic activity. Ion-solvent interaction. Born equation. Ion ion interaction. Activity coefficient and its determination. Debye-Huckel limiting law. Equation for appreciable concentration. Osmotic coefficient. Acivities is concentrated solutions. Robinson-Stoke theory. Ion association. Strong electrolytes. Ion transport, Debye-Huckel treatment. Onsager equation. Limitation of the model. Conductance of high frequencies and high potentials.

Electrodics: Different types of elctrodes. Electrochemical cells. Concentration cell and activity coefficient determination. Origin of electrode potential. Liquid junction potential. Evaluation of thermodynamic proeprties. The electrode double layer: Electrode-electrolyte interface. Theory of multiple layer capacity. Electrocapillary. Lippmann potential. Membrane potential. Elecrokinetic phenomena. Mechanism of charge transfer at electrode-electrolyte interface. Electrolysis. Current-potential curves. Dissolution, deposition and decomposition potentials. Energy barriers at metal-electrolyte interface. Different types of over potentials. Butter-Volmer equation. Tafel and Nernst equation. Rate determining step in electrode kinetics. The hydrogen over voltage. The oxygen over voltage. Theories of over voltage.

Unit IV Surface Chemistry and Colloids 15 h

Different types of surfaces. Examination of surfaces using ESCA, Auger, SEM and STM. Properties of surface phase. Thermodynamics of surface. Surface tension of solutions. Gibbs' adsorption equation and its verification. Surfactants and miscelles. Surface films: Different types Surface pressure and surface potential, and their measurements and interpretation.

The gas-solid inter phase: Types of adsorption. Heat of adosrption. The Langmuir theory-kinetic and statistical derivation. Multilayer adsorption- the BET theory and Harkins-Jura theory. Adsorption from solutions on solids. Langumuir and classical isotherms. Chemisorption-differences with physical adsorption. Adsorpiton isotherms. Adsorption with dissociation. Adsorption with interaction between adsorbate molecules. Measurement of surface area of solids: Harkins-Jura absolute method, entropy method, and the point B method. Use of Langmuir, BET and Harkins-Jura isotherms for surface area determination.

The colloidal state: Multimolecular, macromolecular and associated colloids. Stability of colloids. The zeta potential. Kinetic, optical and electrical properties of colloids. Electrokinetic phenomena: Electrophoresis, electroosmosis, sedimentation potential and streaming potential. Donnan membrane equilibrium.

At least 50 problems to be worked out from all the units put together.

30% of the questions for Examination shall contain numerical problems.

References;

1. G.W.Castellan, “Physical Chemistry”, Addision-Lesley Publishing Co.
2. E.A.Moelwyn Hughes, “Physical Chemistry, Pergamon Press.
3. L.C.Chapoy, “Recent Advances in Liquid Crystalline Polymers”, Elsevier
4. Denbigh, “Chemical Equilibria”, D Van Nostrand
5. F.W.Sears and Salinger, “An Introduction to Thermodynamics, Kinetic Theory of Gases and Statistical Mechanics”, Addison Wesely.
6. M.C.Gupta, “Elements of Statistical Thermodynamics”, New Age International (P) Ltd.
7. L.K>Nash, “Elements of Statistical Thermodynamics”, Addison Wesley Publishing Co.
8. Kesting and Dofman, “Statistical thermodynamics”
9. J.Rose, “Dynamic Physical Chemistry”, Sir Issac Pitman & Sons
10. A.W.Adamson, “The Physics and Chemistry of Surfaces”, Interscience
11. D.R.Crow, “The Principles of Electrochemistry”, Chapman and Hall
12. J.O.M.Bokris and A.K.N.Reddy, “Modern Electrochemistry”, Plenum Rosatta
13. D.A.MacInnes, “The Principles of Electrochemistry”, Dover Publishers
14. D.A.Skoog, D.M.West and F.J.Holler, “Fundametals of Analytical Chemistry”, Saunders College Publishing.
15. C.L.Wilson and D.W.Wilson, “Comprehensive Analytical Chemistry”, Dan van Nostrand
16. J.G.Dick, “Analytical Chemistry, McGraw Hill

AC-304 (A) APPLIED ANALYTICAL CHEMISTRY-I 60 h

Unit I Fundamentals of Polymers and Their Processing 15 h

Basic Concepts, classification, importance of polymers, monomers, initiators, inhibitors, retarders, techniques of polymerisation: mass, solution, suspension, emulsion and gas phase; control of molecular weight and their determination, step polymerisation, radical/chain polymerisation, living and non-living chain polymerisation, co-ordination polymerisation, co-polymerisation, ionic ploymerisation, ring opening polymerisation, introduction, compounding of plastics and rubber, type, nature and role of additives, pre-compounding operations, mixing of polymers and additives, compression molding, transfer, injection and blow molding, extrusion, calendering, thermoforming, roto-molding, casting, sintering and compaction, deep coating, mold design, analysis of defects in molded products.

Unit II Analytical Principles 15 h

Evaluation of analytical data: Accuracy and precision. Standard deviation, variance and coefficient of variation. Student 't' test. Confidence limits. Estimation of detection limits. Errors: Classification, distribution, propagation, causes and minimization of error. Significant figures and computation rules. Correlation analysis: Scatter diagram. Correlation coefficient, r. Calculation of r by the method of least squares.

Volumetric methods: Classification of reactions in volumetry. Theories of indicators: Acid-base, redox, adsorption, metallochromic, fluorescent and chemiluminescent indicators. Complexation titrations: Titrations using EDTA, NTA and Titriplex. Precipitation titrations. Redox titrations. Gravimetric methods: Mechanism of precipitate formation. Aging of precipitates. Precipitation from homogeneous solutions. Coprecipitation and postprecipitation. Contamination of precipitates. Washing, drying and ignition of precipitates. Organic reagents used in gravimetry: Oxine, dimethylglyoxime and cupferron.

Thermal methods of analysis: Principles and instrumentation of TG and DTA. Complementary nature of TG and DTA. Differential scanning calorimeter (DSC). Applications of thermal methods in analytical chemistry and in the study of minerals and polymers.

Unit III Science of Corrosion and Corrosion Control. 15 h

Corrosion, theories of corrosion. Kinetics of corrosion, Evan's diagram, thermodynamics of corrosion-Pourbaix diagram. Forms of corrosion. Corrosion prevention: modification of materials, corrosion inhibitors, protective coatings, cathodic and anodic protection. Corrosion testing techniques: Evaluation of corrosion effect- XRD, ESCA, FTIR and surface techniques Corrosion in industries with special reference to oil and mining industries.

Unit IV Electroanalytical Methods **15 h**

Potentiometric methods: Reference electrodes and indicator electrodes. The hydrogen, calomel, Ag-AgCl electrodes. The glass electrode – its structure, performance and limitations. Measurement of pH. Petentiometric titrations. Redox and precipitation titrations. Electrogravimety: Principle and method. Determination of Cu. Separation of metals. Conductometry: Principle and method. Conductance measurements. Conductometric titrations. Coulometry: Principle and method. Coulometric titrations.

References;

1. M.C.Day and j.Selbin, "Theoretical Inorganic Chemistry", Affiliated East-West Press
2. F.A.Cotton and G.Wilkinson, "Advanced Inorganic Chemistry, John Wiley & Sons
3. J.E.Huheey, "Inorganic Chemistry – Principles of Structure and Reactivity", Harper Collins College Publishers.
4. A.I.Vogel, "A Text Book of Quantitative Inorganic Anaysis", Longman
5. D.A.Skoog, D.M.West and F.J.Holler, "Fundamentals of Analytical chemistry", Saunders College Publishing.
6. W.W.Wendlandt, "Thermal Methods of Analysis", John Wiley & Sons
7. G.Friedlander and J.W.Kennady, "Introduction to Radiochemistry", John Wiley & Sons
8. Injection Moulds & Moulding, J.B Dym, Van Ronstrandt-Reinhold, New York, 1980.
9. Polymer Process Engineering, E.A Grulke, PTR Prentice Hall, Eaglewood Chiffs, New Jersey,1994.
10. Principles of Polymer Engineering, N.G Mccrum, C.P Buckley & C.P Bucknell, Oxford Engineering Press, Oxford, 1988.
11. Extrusion of Plastics, E.G Fisher, Newness-Butterworth, London, 1976.
12. Principles of Polymer Processing, R.T. Fenner, Macmillan, London, 1979

AC 304 (B): POLLUTION MONITORING AND CONTROL – I 60 h

Unit – I: Regulatory Aspects 15 h

Industrial emissions, liquids and gases, pollution caused by various chemical industries and its overall effect on quality of human life and environment. The environment act, The Enviroment (Protection) Act-1986, General Powers of the Central Government Preventation Control, and Abatment of Environmental Pollution, Hazardous waste (management and handling rules 1989) Environmental legistration, water (preventation and control of pollution) Act1974. its implication applications and effectiveness, in industrial pollution control, water quality management in India, Indian standards, IS – 2490, IS – 33660, IS – 2296, MINAS for sugar industries, distilleries, synthetic fiber industries, oil refineries, pesticides, industry an mercury from chloralkali industry, Air (Preventation and control of pollution) Act 1981, good analytical practices for proper assessment of pollutions, Management of regulatory requirements.

Unit –II: Pollution and Its Measurement*:* 15 h

Nature of industries effluents, gaseous and liquid effluents, methods of gas analysis, analysis of CO, CO_2, SO_2, NO_2S, Cl_2, in the gaseous effluents, particualate matter, particle size analysis AAS applications process water, the free acids and bases dissolved organic and inorganic compounds like alkali and alkaline salts, SO_4PO_4, NO_2 NO, determination of iron and calcium, suspended solids, total cations and anion, estimation of industrial metals, recovery techniques, Organic trace chemicals in waste water, volatile carcinogenic matter in waste water, recovery and recycling techniques, biological methods of waste water treatment.

Unit III Environmental Analysis in Process Industries 15 h

Environmental Chemistry, Calibration and standardisation of pH, conductivity; nepholometer and other water quality monitoring instrument; determination of pH, acidity-alkalinity, total suspended solids, total dissolved solids (TDS), total hardness (TSS) and Ca & Mg hardness, chloride, sulphate, nitrate, oil and grease, DO, COD, BOD chlorine demand, break-point chlorination and free residual chlorine.
Soil sampling, description of the soil horizon, determination of soil pH conductivity and salinity soil organic carbon, nitrogen and phosphorus; sodium and potassium; CEC available sulphur.
Sampling and analysis of inorganic and organic particulates, SO_x , NO_x, NH_3 etc.
Demonstration of UV-VIS spectrophotometer, Flame photometer, AAS, GC, TOC

Unit IV Hazardous Waste Managements and Its Standards 15 h

Environmental Chemistry of Hazardous substances: Classification and characteristics of hazardous substances and wastes, Effects and fate of Hazardous wastes. Reduction, treatment and disposal of hazardous wastes with special reference to chemical treatment. Photolytic reactions

References:

1. A.C. Stern Air pollution, Engineering control Vol. (IV) A.P
2. P.N. Cheremisioff and R A Yound : air pollution control and design hand book Vol – I &II Dekker.
3. Liptak: Air pollution S P Mahajan: Pollution control in process industries (MH)
4. S.P. Mahajan: Pollution control in process Industries (MH)
5. Wark & Warnor : Air Pollution Origin & Control
6. A. K. De: Environmental Chemistry
7. S.M. Khopkar: Environment pollution analysis
8. K.S. Ramlho: Introduction to waste water treatment process(A.P)
9. M.J. Hammar: Water and waste water Technology (J.W)
10. R. Horne: Environmental chemistry, Wiley

AC 304[C] ADVANCED ORGANIC CHEMISTRY-I **60 h**

Unit I NMR Spectroscopy and Structure Elucidation **15 h**

Chemical shifts, anisotropic effects and coupling constants in organic compounds. Spin-spin interactions in typical systems. Analysis of 1st order spectra. Simplification methods for complex spectra: use of high field NMR, shift reagents, chemical exchange and double resonance. Introduction of FT (pulse) NMR; NOE; DEPT and 2DNMR. ^{13}C NMR and ^{13}C chemical shifts. Spectral interpretation and structure identification. Spectral interpretation using actual spectra taken from standard texts. The problems on structural elucidation based on spectral data.

Unit II IR and Mass Spectroscopy **15 h**

Principle, characteristics, group frequence's in IR. Identification of functional groups and other structural features by IR. Hydogen bonding and IR bands. Sampling techniques. FTIR and its instrumentation. Organic mass spectroscopy. Ion production methods: El, Cl, FAB, Electrospray and MALDI. Magnetic, TOF, Quandrupole and Ion cyclotron mass analyzers. MS technique. Characteristic EIMS fragmentation modes and MS rearrangements

Unit III Organic Synthesis **15 h**

C-C and C=C bond forming reactions – Mannich, Reimer-Tiemann, Simon-Smith, Vilsmeier-Haack, Reformatsky and Ullmann reactions. Strok enamine reaction. Shapiro, Witting – Horner, Peterson, Heck, Stille and McMurray reactions. Ring formation by Dieckmann, Thorpe and Acyloin condensations. Robinson ring annulation. Synthesis of small rings. Simon-Smith reaction. Reduction and oxidation in synthesis. Catalytic hydrogenation. Birch reduction. Wolff-Kishner reduction. Hauang-Milon modification. Clemmenson reduction. Boranes, LAH, Sodium borohydride as reductants. Dehydrogenations, Oppenauer oxidation, HlO_4, OsO_4 and m-ClC_6H_6COOOH and their applications.

Unit IV **15 h**

a) Biogenesis 08 h

Alkaloids (pyridine, morphine and indole type), terpenoids of classes with examples, cholesterol, flavones, coumarins, carbohydrates and proteins.

b) Vitamins 08 h

Synthesis and structure of biotin and vitamin B_2, synthesis of vitamin B_1, biological functions of B_6, B_{12}, folic acid and thiamine.

References;

01. D.H.Williams and I.Fleming, "Spectroscopic Methods in Organic Chemistry", Wiley.
02. W.Kemp, "Organic Spectroscopy", Longman
03. J.March, "Advanced Organic Chemsitry", Wiley
04. R.O.C.Norman and A.Coxon, "Modern Synthetic Reactions", Chapman and Hall
05. M.B.Smith, "Organic Synthesis", McGraw-Hill
06. R.K.Bansal, "Synthetic Applications in Organic Chemistry", Narosa
07. R.J.Simmonds, "Chemistry of Biomolecules", Royal Society of Chemistry I.L.Finar, "Organic Chemistry" Vol2 , Longman
08. R.J.Young, "Introduction to Polymer Science", John Wiley & Sons
09. F.W.Billmayer, Text Book of Polymer Science", John Wiley & Sons
10. G.Odian, "Principles of Polymerization", John Wiley & Sons
11. J.M.G.Cowie, "Polymers: Chemistry and Physics of Modern Materials", Blackie.
12. K.J.Sauders, "Organic Polymer Chemistry", Chapman and Hall
13. 13. J.B. Hendrickson, The molecules of nature.
14. 14. Peter Bernfield, The biogenesis of natural products,
15. 15. R.T. Slickenstaff A.C. Ghosh and G.C. Wole , Total synthesis of steroids.
16. 16. The Chemistry of Natural products, vol. Nakanishi

M. Sc. Part –II Semester III
Applied Chemistry Practical Course
(Practical No. AC-311 and AC-312)

Applied Inorganic Chemistry Practicals

1. Ore Analysis - 3
2. Alloy Analysis - 3
3. Preparation of coordination complexes
4. Ion exchange study of separation of mixtures & estimations
5. Spectrophotometry
6. Separation & estimation of ions using ion exchange chromatography
7. Nephelometry
8. Potentiometry
9. Conductometry
10. Thermal analysis
11. Magnetic properties of transition metal complexes
12. Spectro Fluorimetry
13. Solvent extraction
14. Nuclear chemistry
15. Soil analysis
16. Data analysis

(Any other suitable experiments may be added)

References

1. A.I.Vogel, "A Textbook of Quantitative Inorganic Anaysis", Longman
2. I.M.Kolthoff, V.J.Elving and Sandell, "Treatise on Analytical Chemistry", Interscience.
3. I.M.Kothoff and Strenger, "Volumetric Analysis", Interscience
4. Fruman and Welcher, "Standard Methods of Inorganic Analysis", Van Nostrand
5. G.Schwarzenback, "Complexomtric Titrations", Interscience
6. D.A.Skoog and D.M.West, "Analytical Chemistry – An Introduction", Reinholdt.
7. W.G.Palmer, "Experimental Inorganic Chemistry", Cambridge University Press
8. R.S.Drago, "Physical Methods in Inorganic Chemistry", Affiliated East-West Press

M. Sc. Part –II Semester III
Applied Organic Chemistry Practicals

1. Preparation of organic compounds by multi-step reactions involving nitration, halogenation, acetylation anoxidation.

2. Estimation of ester, acids, reducing sugars, phenols, amines, ketones, nitrogen and sulphur.
3. Quantitiative analysis of (a) milk and butter, (b) fats, oils and soaps, (c) drugs such as acetyl salicylic acid, aspirin, phenacetin and suphanilide, (d) caffeine, sugar and starch food, (e) spectrophotometric determination of simple organic compounds, and (f) spectrophotometric determination of cholesterol, ascorbic acids, glucose and ammonia.
4. Characterization of organic compunds using IR, UV-Vis and NMR spectral methods.

(Any other suitable experiments may be added)

References;

1. A.I.Vogel, "A Textbook of Practical Organic Chemistry", Longman
2. A.I.Vogel, "Elementary Practical Organic Chemistry – Part 3: Quantitative Organic Analysis", Longman
3. F.G.Mann and B.C.Saunders, "Practical Organic Chemistry", Longman
4. B.B.Dey and M.V.Sitaraman, "Laboratory Manual of Organic Chemistry",
5. B.L.Oser (Ed), "Hawk's Physiological Chemistry", Tata McGraw-Hill
6. British Pharmacopoeia and Indian Pharmacopoeia,
7. A.C.Agarwala and R.M.Sharma (Eds), "A Laboratory Manual of Milk Inspection", Asia Publishing House

M. Sc. Part –II Semester III
Applied Physical Chemistry Practicals

Potentiometry

1. To determine instability constant & stiochiometry of silver ammonia complex potentimetrically.
2. Determination of Thermodynamic Parameters for electrochemical reactions. (To determine ΔG^o, ΔH^o,and ΔS^o for the formation of 1 mole cadmium in 1 wt. % amalgam at 25^o C and activity coefficient of solution).

Spectrophotometry

1) To determine pK value of methyl red indicator at room temperature spectrophotometrically

2) To determine stoichiometry & stability constant of ferric Sulphosalicylic acid/ salicylic acid complex by Job's Method and mole ratio method spectrophotometrically.

3) To dsetermine equilibrium constant of reaction $KI + I_2 \longrightarrow KI_3$ spectrophotometrically

Amperometry

To determine unknown concentration of Iodine using amperometry

Chemical Kinetics

To determine the order of reaction between acetone and iodine catalyzed by acid.

Conductometry

To determine equivalent conductance at infinite dilution of strong electrolytes and weak acid by using Kolharausch Law and dissociation constant for weak acid conductometrically.

Cryoscopy

To determine molecular weight and state of benzoic acid in benzene.

Moving boundary Method

To determine transport of H+ ions by using Moving boundary method.

pH - Metry

To determine dissociation constant of carbonic acid pH metrically.

Polarography

To determine half wave potential of a given ion using half height method, differential method and wave equation method

Latent heat of Fusion

Determination of latent heat of fusion of a given solid.

Thermochemistry

Determination of heats of dilution and integral heat of solutions.

(Any other suitable experiments may be added)

References;

1. A.Finlay and J.A.Kitchener, “Practical Physical Chemistry, Longman
2. F.Daniels and J.H.Mathews, “Experimental Physical Chemistry”, Longman

3. A.M.James, “Practical Physical Chemistry”, J.A.Churchil
4. H.H.Willard, L.L.Merritt and J.A.Dean, “Instrumental Methods of Analysis”, Affiliated East-West Press
5. D.P.Shoemaker and C.W.Garland, “Experimental Physical Chemistry”, McGraw-Hill
6. A.I.Vogel, “A Textbook of Quantitative Inorganic Chemistry”, Longman
7. J.B.Yadav, “Advanced Practical Chemistry”, Goel Publishing House
8. J.J.Lingane, “Electroanalytical Chemistry”, Interscience
9. L.Meites, H.C.Thomas and R.P.Bauman, “Advanced Analytical Chemistry McGraw Hill

M. Sc. Part –II Semester III
Applied Analytical Chemistry Practicals

1. Food Analysis
2. Cosmetics Analysis
3. Drug Analysis
4. Vitamin Analysis
5. Thermal Analysis of Inorganic Materials

References;

1. A.I.Vogel, “A Textbook of Practical Organic Chemistry”, Longman
2. A.I.Vogel, “Elementary Practical Organic Chemistry – Part 3: Quantitative Organic Analysis”, Longman
3. F.G.Mann and B.C.Saunders, “Practical Organic Chemistry”, Longman

(Any other suitable experiments may be added)

SEMESTER IV

M. Sc. Part-II APPLIED CHEMISTRY

AC 401 APPLIED INORGANIC CHEMISTRY II **Total 60 h**

Unit I **15 h**

a) Infrared and Raman Spectroscopy 09 h

Molecular vibrations, force constants, Molecular vibrations and absorption of Infrared radiations Raman Spectroscopy, polarized Raman lines, Use of symmetry considerations to determine the no. of lines in IR and Raman Spectra, Spectra of gases, applications of Raman and Infrared spectroscopy. Selection rule in Inorganic structure determinations, Hydrogen bonding and infrared spectra, metal ligand and related vibrations.

b) Microwave spectroscopy 06 h

Basic concept, rotation spectra of simple inorganic compounds, Classification of molecules, rigid rotor model, effect of isotopic substitution on transition frequencies & intensities non rigid rotor, stark effect nuclear and electron spin interaction and effect of external field. Applications of Micro wave Spectroscopy.

Unit II Inorganic Pharmaceutical Chemistry **15 h**

Introduction of Inorganic Pharmaceutical Chemistry, Pharmacopoeia, Indian Pharmacopoeia, British Pharmacopoeia, Impurities and Pharmaceutical substances and their limits, Tests for purity and methods for purification of inorganic substances. Quantitative analysis of Inorganic pharmaceutical substances. Antioxidants, Gastrointestinal agents, Topical agents Inhalants, Expectorants, Emetics and respiratory Stimulants, Major intra and Extra cellular electrolytes, Pharmaceutical aids.

Unit III Instrumentation for Characterization of Inorganic Materials- I **15 h**

a) Microscopy: Transmission Electron Microscopy[SEM]; High resolution Transmission Microscopy[HRTEM]; Scanning Electron Microscopy[TEM]; Scanning Tunneling Microscopy[STM]; Atomic Force Microscopy[AFM];

b) Spectrometric techniques: Atomic Absorption Spectroscopy (AAS); Raman Spectroscopy; Electron Spectroscopy for Chemical Analysis

c) Nuclear Methods

d) Thermoanalytical Methods

Unit IV Instrumentation for Characterization of Inorganic Materials -II **15 h**

a) Compositional Analysis tools: X-ray Diffraction (XRD); SIMS/MS; Auger Electron Spectroscopy

b) Superconducting Quantum Interface (SQUID) Maganetometry

c) Brunauer-Emmett-Teller Gas Absorption Surface Area Measurement and Pose Structure Analysis (BET Method)

References;

1. Pharmaceutical Chemistry, Inorganic – G R Chatwal, Himalaya Publishing House

2. K J Klabunde, Nanoscale materials in Chemistry, Wiley Interscience 2001

3. R W Cahan, The Coming of Material Science, Pergamon (2001)

4. A R West, Basic Inorganic Chemistry, II Ed, Jhon Wiley & Sons (1999)

5. U Schubest and N Husing, Synthesis of Inorganic Materials, Wiley VCH (2000)

6. David Thompson, Insight into Speciality Inorganic Chemicals, Royal Society of Chemistry (1988)

AC 402 APPLIED ORGANIC CHEMISTRY-II **60 h**

Unit I Chemistry of Biopolymers **15 h**

Peptides and their synthesis. Protecting goups and peptide bond formation in SPPS. Helical and sheet conformations of polypeptides. Structure organization of proteins. Chemistry of nucleic acid bases A.G.C.T and U and their synthesis. Synthesis of adenosine and ATP. Structure of DNA. Automated oligonucleotide synthesis by Phosphoramidite method – Reagents and protecting groups. Sequencing of polynucleotides and polypeptides. Structure of Starch, Cellulose, Glycogen and Chitin.

Unit II Chemistry of Polymers **15 h**

Types and mechanism of polymerization reactions. Step-growth, free radical, addition, ionic, ring opening and gorup transfer polymerizations. Copolymers. Characterization of polymers. Methods of measurements of molecular mass and size. Stereochemistry of polymers. Stereoregularity and its control. Ziegler-Natta catalysts. Gelation and network formation. Polymer architecture, configuration and conformation. Frictional properties and mechanical properties. Glassy and rubbery states, visco-electricity, crystallization and melting of polymers. Relation between structure, property and performance. Maufacture and applications of polyolefins, thermoplastics, polyamides, polyesters, polyurethanes, epoxies and industrial polymers.

Unit III Chemistry of Drugs & Pharmaceuticals **15 h**

Classification of drugs based on activity. Synthetic procedure for the present commonly used drugs of each type, Manufacturing of few important drugs.
Semi synthetic penicillin's. Vitamins: type of vitamins, synthesis of Vit – A and Vit – E, Vitamine – II of niacinamide, Use of NMR in structure determination of drugs and pharmaceuticals: Instrumentation and Applications.

Unit – IV: Agrochemicals: **15 h**

Organophosphorus pesticides: Malathion, Monocrotophos, dimethoate, chloropyriphos, chloropyriphos, Dichlorpyriphos, Dichlororous, phenthoate. Carbamates: Carbonyl, Bygon, Ziran, Zineb, Maneb, Alaicarb. Pyrenthroids: Natural pyrenthrins: Isolation and structures synthetic Pyrethroids: Allethrin, cypermethrin, Phenvalerate. Insect Peromones and Repellcnts: pheromones, general introduction and application in integrated. Past management (No Synthesis). Repellents: Survey and synthesis and synthesis of following repellents: N,N-Diethyl - 3-methyl Benzamide, N,N-Diethyltoluamide, 2 – Ethyl -1,3 hexanedial, Butopytranexyl. Dimethylcabonate, Dimethylphthalate. Use Pheromones in post management. Plant growth regulaters and Herbicides: General survey of IAA, β – Naphthoxyacetic acid, 2,4, - D, Maleic hydrazide, Daminozide, paraguat, glyphosine.

References:

1. Text Book of Polymer science, F.W.Billmeyers Jr Wiley
2. Polymer Science, V.R.Gowarikar, N. V. Vishwanathan and J Shreedhar, Wiley
3. Functional monomers and polymers, K. Takemote, Y Inkiand R m Ottanbrite.
4. contemporary Polymer Chemistry, H.R.Alcoek and F W Lambe, Practice Hall.
5. Physics and chemistry of polymers, J M G,Cowie, Blackie, Academic and Prfessinoal.
6. Burger : Medicinal Chemistry (I.W.)
7. W.O. Foye: Principal of Medicinal chemistry (I.E)
8. Lendieer and Mitscher: The organic chemistry of drug synthesis (I.W)
9. N.N.Melnikow: Chemistry of Pesticides (Springer)
10. M.B. Green, G.S.Hartley West: Chemicals for crop protection and
11. pest managements (pergamon)
12. R. Cremlyn: Pesticides

AC 403 ADVANCED ORGANIC CHEMISTRY-II 60 h

Unit-I Green Chemistry 15 h

Introduction to the principles of green chemistry – prevention of waste, atom economy, less hazardous chemical syntheses, designing safer chemicals, safer solvents and auxiliaries, design for energy efficiency, reduce derivatives, renewable feedstock, catalysis, design for degradation, real time analysis for pollution prevention, and inherently safer chemistry for accident prevention. Green synthesis, clean routes, supercritical solvents, ionic liquids, green catalyst, auto-exhaust catalyst and clean technology.

Unit II Oxidation & Reduction in Organic Chemistry 15 h

Reduction: Catalytic hydrogenation and dehydrogenation, dissolving metal reduction, metal hydride reduction of carbonyl compounds and other functional groups, Meerwein-Pondorf Verley reduction, hydroboration and related reaction including reaction of alkyl borane and tributyltin hydride, Wolff-Kishner reduction, reduction of diimide.
Oxidation: Oxidation with Cr and Mn compounds: oxidation of alcohol, aldehyde, C=C, C-H bonds in organic molecules, Pyridinium chloro chromate (PCC), Oxidation with peracids and other peroxides: C=C, Sharpless epoxidation, Baeyer-Villiger oxidation.
Other types: Prevost and Woodward hydroxylation, *cis*- and *trans*- hydroxylation, glycol cleavage reagent; $KMnO_4$, OsO_4, HIO_4, $Pb(oAc)_4$, mercuric acetate; SeO_2 oxidation of allylic C-H bond.

Unit III Chemistry of Natural Products 15 h

Structure and synthesis of alpha-Pinene, Camphor, Cadenine and Caryophyllene. Hofmann, Emde and von Braun degradation in alkaloid chemistry. Structure elucidation of Papaverine, Quinine and Morphine. Synthesis of Quinine and Papaverine. Structure and synthesis of beta-Carotene, Flavone, Isoflavone, Cyanin and Quercetin. Biosynthesis of terpenes and alkaloids. Classification and structure of lipids and their biofunctions. Nomenclature, structure (not elucidation) and biosynthesis of Prostaglandins PGE_2, and PGF_{1v}.

Unit IV Selected Organic Reactions and Reagents: 15 h

Favorski, Stork-enamine, Michael addition, Mannich, ene, Hofmann-Loffler-Freytag, Shapiro, Chichibabin and Wittig reaction, Robinson annulation, Gilman's reagent, Lithium dimethyl cuprate, Dicyclohexyl carbodimide, Lithium diisopropylamine, 1,3–dithiane (reactivity umpolung), Trimethyl silyl iodide, Baker Yeast, Phase-transfer catalysts.

References;

1. L.M.Harwood, “Polar Rearrangements”, Oxford University
2. J.March, “Advanced Organic Chemistry”, Wiley
3. S.N.Issacs, “Physical Organic Chemistry”, Longman
4. P.Y.Bruice, “Organic Chemistry”, Prentice Hall
5. H.Arora, “Organic Photochemistry and Pericyclic Reactions”
6. C.H.Dupuoy, and O.L.Chapman, “Molecular Reactions and Photochemistry”, Prentice Hall
7. J.M.Cozon and B.Holton, “Organic Photochemistry”, Cambridge University Press
8. S.H.Pine, “Organic Chemistry”, McGraw-Hill
9. I.L.Finar, “Organic Chemistry” Vol w, Longman
10. R.P.Wayne, “Principles and Applications of Photochemistry”, Oxford University Press
11. J.Kagan, “Organic Photochemistry”, Academic Press
12. R.J.Simmonds, “Chemistry of Biomolecules”, Royal Society of Chemistry J.Mann and others, “Natural Products – Their Chemistry and biological significance”, Longman
13. I.L.Finar, “Organic Chemistry” Vol 2, Longman
14. W.Kar, “Medicinal Chemistry”, Wiley Eastern
15. Advanced Organic Chemistry, Reaction Mechanism and Structure, Jerry March, John Wiley.
16. Modern Synthetic Reaction, H.O. House, W.A. Benjamin.
17. 17. Principles in Organic Synthesis, R.O.C. Norman and J.M. Coxon.18. Reactions Mechanisms & Problems in Organic Chemistry, P Chattapadhyay, 1st Edn, Asian Books Private Limitted, New Delhi
18. Organic Synthesis, Michael B Smith, McGraw Hill, 2nd Edn, 2004, New York.

AC 404[A] APPLIED ANALYTICAL CHEMISTRY- II 60 h

Unit I Principle of Chemical Engineering 15 h

Introduction to chemical engineering. Comparison of academic and industrial Chemistry. Material and energy balances. Units and dimensions. Fluid mechanics. Fluid statistics. Benoulli equation. Flow measurements. Pipes, pipe fittings and valves. Heat transfer: Steady state heat conduction. Unsteady state heat conduction. Heat flow by convection. Heat exchagers and evaporators. Distillation: Vapout-liquid equlibrium. The fractionating column. Comparison of plate columns and packed columns. Mass transfer operations. Principles of extraction, leaching and absorption. Chemical reactions: Batch and continuous reactors. Concepts ofresidence time, space time and space velocity.

Unit II Pollution and its Control 15 h

Air pollution: Composition of air. Classification of pollutants. Sources of air pollutants. Industrial pollution: Power plats. Fertilizers. Petrochemicals. Automobile pollution. Water pollution: Water quality criteria for domestic and industrial uses. Analysis of waree and wastewater. Principles of water and wastewater treatments. Removal of organics and harmful inorganics from water and wastewater. Biological treatment of wastewater: Theory and practice. Sludge treatment and disposal.

Unit III Manufacturing of Organic Chemicals 15 h

Raw materials and routes to major organic products. Flwo sheets and engineering aspects of the manufacture of of important products such as nitrobenzene, linera alkyl enzene sulphonate, chlorobenzene vinyl chloride, DMT, ethyl acetate, cummene, alkyl benzenes, cyclohexanone, pthalic acid, soaps, detergents and hydogenation of oils. Pharmaceuticals: Manufacturing processes of aspirin, vitamin A and paracetamol. Pesticides: Manufacture of BHC, DDT, Carbaryl and Malathion. Manufacture of dyes.

Unit IV Manufacturing of Inorganic Heavy Chemicals 15 h

Introduction to chemical industry: Flow sheet preparation. Principles of process selection and operation selection. Basic raw materials and routes to major inorganic products. Flow sheets and engineering aspects of the manufacture of sulphuric acid, sodium hydroxide, chlorine, ammonia, phosphoric acid, nitric acid, ammonium nitrate, urea, glass, ceramics, refractories and Portland cement.

References;

1. E.K.Rideal, “Concepts in catalysis”, Academic Press
2. A.Clark, “The Theory of Adsorption and Catalysis”, Academic Press
3. R.Pearce and W.R.Patterson (Eds.), “Catalysis and Chemical Processes.”,Backie and sons
4. J.M.Betty, “Applied Industrial Catalysis”, Academic Press
5. Coulson and Richardson, “Chemical Engineering”, Vol. 1,2, & 3
6. McCabe, “Unit Opeartion of Chemical Engineering”
7. Peter Wiseman, “Industrial Organic Chemistry”
8. N.R.Nerris Shreve, “Chemical Process Industries”
9. Dridens, “Outline of Chemical Technology”
10. B.K.Sharma, “Industrial Chemistry, Goel Publishing House

AC 404[B] POLLUTION MONITORING AND CONTROL-II **60 h**

Unit – I: **15 h**

A. Removal of Heavy Toxic Metals:

07 h

Chromium, Mercury, Lead, Cadmium, Arsenic analytical methods of determination of small amounts of the metal pollutants, copper recovery, treatment of waste to remove heavy metals, recovery techniques.

B. Removal of Particulate Matter: 08 h

Particulate matter and dynamics of particles separations, Particulate matter in gas sream, filtering, gravity separation, liquid scrubbing cyclone separations, electrostatic precipitations safety of workers analysis of particulate matter.

Unit –II: Removal of Phenolic Residue*:* **15 h**

Sources of Phenolic residues, Analytical methods, treatment by using stream gas stripping, ion – exchange, solvent extraction, oxidation methods, Microbiological treatment General nature of Organic residue not mentioned so far. Role of Vapor pressure, role of solubility, effect of pH on solubility extractive methods of recovery and recycle, Chemical methods of conversion to less soluble nontoxic or biodegradable and products carcinogens, economics of and recycle methods. Incineration of no recyclable concentrates and residues.

Unit – III: Removal of Sulphur Dioxide and Nitrogeneous Pollutants*:* **15 h**

Origin of SO_2 and its hazard, Analysis of SO_2, SO_2 control methods, desulphurization of fuels, Indian cola and Indian Crude oil. Economics of SO_2 control measures NOx, dissolved NOx, nitrites, ammonia, Urea and other nitrogene containing compounds in the effluents fertilizer explosive, industrial effluents, effluents from nitro aromatic industries, analytical methodology, Photochemistry of air pollution.

Unit – IV: **15 h**

A. Biotechnology in Chemical Industry: 10 h

Essential elements in biological system Mettallo – proteins and mettallo– enzymes. Metal ions as a charge carriers Health effects due to deficiency and excess of metals of non-metals Biotechnology for the production of chiral compounds. Role of biotechnology in Industry.

B. Polymer Recycling*:* 05 h

Environmental and polymer Industries. Recycling of polymers waste.

References:

1. S.P. Mahajan: Pollution control in processes iIndustries (J.W)
2. P.N.Chennsioff and R. A Young: Air Pollution control and design Hand Book and recovery (J.W)
3. J.R. Holmes: Refuse recycling and recovering (J.W)
4. M. Sitting: Resources recovery and recycling Hand Book and Industrial Wastes (NDS)
5. J.O. Niagh: Sulphur in the Environment Vol. I & II (J.W)
6. P.S.Minor: The Industry/EPA controntation (MGH)
7. R.B.Pojaselc: Toxic and Hazardous waste disposal Vol. I &II (AAS)
8. S.M.Khopkar: environmental pollution analysis
9. A.K.Dey: Environmental Chemistry
10. W.Handley: Industrial safety Handbook
11. J.E.Huheey et. Al. Inorganic Chemistry, 1993
12. J.E.Huneey etal. (1993) Inorganic Chemistry.

AC-404[C] INORGANIC CHEMICAL INDUSTRIES 60 h

Unit – I: Special Materials for Electronic Industry: 15 h

a. Ferrites and magnetic materials.
b. Phosphorus for various uses, Luminous paints.
c. High purity Silicon, Germanium, Gallium, Indium and Arsenic.
d. Alloys for various uses in electrical and electronic Industry.
e. High temperature materials.
f. Alloy and ceramics superconductors.

Unit – II: Fertilizer Industries. 15 h

General Principles of plant Nutrition: Essential plant nutrients, functions of the essential elements, classification of commercial nitrogenous fertilizers.
Classification, manufacture of ammonium sulphate, Urea, Ammonia nitrate fertilizers
Commercial phosphatic fertilizers.
Classification, manufacturing process and properties of phosphatic fertilizers, single super phosphate, triple super phosphate, manufacturing of phosphoric acid by electric furnace process.
Commercial potassic fertilizers:
Chemicals of potassium compounds, classification, manufacturing process and properties of potasium fertilizer, mariate of potassium, potassium sulphate, mixed fertilizer. Micronutrients: Role and deficiency symptom of micronutrients.
Biofertilizers: classification, demands and production,
Position of fertilizer Industries in India.

Unit – III: Metal Finish Technology: 15 h

Electro refining of metals, electroplating of nickel, chromium, copper, cadmium, silver and Gold, surface treatment technology, surface coats.

Unit – IV: 15 h

A. **Glass and Refractory Materials**:
Raw materials, Sodaglass, borosilicate glass, Lead Glass, Colored Glass,
Refractory: Raw materials, clay potys, Zeolotes.
B. **Industrial Gases**:
Manufacture and industrial uses of H_2 O_2, N_2, CO_2 & acetylene. Liquefaction of gases, production of low temperatures,
C. **Chemicals of Utility**:
Inorganic fine chemicals, magnesia, alumina, AlCl3, calcium carbonate, sodium silicate, MnO2, FeSO4, PbO2, Na2HPO4 and NaOH.

References:

1. Lowenheim F A (1974) Modern Electroplating III Ed Chapman & Hall, Landon.
2. Gable, D: Principal of metal Treatment and protection. Pergaman, Press Oxford (1978)
3. G.A. Keneth: Electroplating for Engineering's A Hand Book IIIrd Edn Van Nastrad Reinbold Co London
4. F A Lowinbein: Modern Electroplating, Electroplating Publication New Jersey
5. Burke Progess in ceramic science Vol. IV
6. R.R.Iash: afromulary of paints and other coating Vol. I
7. J.D. Gilchrist: Extraction Metallurgy (Pergamon)
8. W.H. Dennis: Foundation of steel and iron Metallurgy (Elsevier)
9. S.D. Shukla & G N Pandey: A text book of chemical technology Vol. 1
10. F A. Henglein: Chemical Technology (Pergamon)

M. Sc. Part II Semester-IV
Applied Chemistry Practical Course
(Practicals No. AC-411 and AC-412)

Applied Inorganic Chemistry Practical

Ore analysis (Three)

1. preparation of coordination compounds(Three) and preparations of mixed metal oxides (two)
2. Ion exchange chromatography; separation of multicomponent mixtures
3. Solvent extraction
4. Spectrophotometry
5. pH Metry
6. Conductometry
7. Polarography
8. Electrogravimetry
9. Nuclear and radiochemistry

B) Interpretation exercises

1. X-ray powder diffraction analysis of cubic compound

a. Determination of lattice constants and geometry
b. Partical Size
c. Density

2. Interpretation of Mossbaur spectrum with reference to determination of a) isomer shift b) quadruple splitting c) Internal magnetic field d) general comment
3. Interpretation of IR spectrum with reference to stretching vibration 0-2 C=N, C=O, N-, M-O
4. Interpretation of NMR spectrum with reference to calculation of chemical shifts and general comments.
5. Interpretation of absorption spectra for

a. Verification of position of ligands in spectrochemical series.
b. Determination of gemetry (Octahedral, square planer, tetrahedral) of a given compound.
c. Calculation of spectral splitting parameters.

6. Interpretation of polar gram for determination of half wave potentials and unknown concentration.
7. Calculation of band gap of semiconductors with the help of plots of log & vs. 10 3/4.

In all 20 experiments with at least five expts in each course should be completed. Addition of new expts in place of existing one may be allowed. A veriety of small projects designed by by teacher based on the interest of ttu stule and capabilities should be worked out. Project work and the review report will be examined by internal and external examiners.

(Any other suitable experiments may be added)

References

01. A.I.Vogel, "A Textbook of Quantitative Inorganic Anaysis", Longman

02. I.M.Kolthoff, V.J.Elving and Sandell, "Treatise on Analytical Chemistry", Interscience.

03. I.M.Kothoff and Strenger, "Volumetric Analysis", Interscience

04. Fruman and Welcher, "Standard Methods of Inorganic Analysis", Van Nostrand

05. G.Schwarzenback, "Complexomtric Titrations", Interscience

06. D.A.Skoog and D.M.West, "Analytical Chemistry – An Introduction", Reinholdt.
07. W.G.Palmer, "Experimental Inorganic Chemistry", Cambridge University Press
08. R.S.Drago, "Physical Methods in Inorganic Chemistry", Affiliated East-West Press

M. Sc. Part II Semester-IV
Applied Organic Chemistry Practicals

Three stage preparations starting with 5g or less & TLC.

1. Estimation of sulphur, nitrogen and functional groups, pharmaceutical analysis.

2. Polyfunctional analysis

3. Organic preparations

1. Preparation of benzanilide by Beckmann rearrangement
2. Preparation of anthranilic acid
3. Preparation of phthalimide
4. Preparation of N- bromosuccinamide
5. Preparatin of p- Amino benzoic acid
6. Preparation of p- chloro nitrobenzene by Sandmeyer reaction
7. Preparation of p- Idonitrobenzene by Sandmeyer reaction
8. Pinacol- Pinacolone rearrangement

4. Any other suitable experiments may be added

References books;

1. A Textbook of Practical Organic Chemistry – A. I. Vogel.
2. Practical Organic Chemistry – Mann & Saunders.
3. A Handbook of Quantitative & Qualitative Analysis- H. T. Clarke.
4. Organic Synthesis Collective Volumes.
5. Organic Reactions (Wiley).

M. Sc Project/ Industrial Training/Review Articles:-[As a partial fulfillment of M Sc Applied Chemistry Course]

In the final semester, students have to carry out project work either at SU or in any R&D laboratory (Private, public and Government) Universities, Institutes of national repute across the country under the guidance of a Scientist or a Faulty member. The Area of the work is to be decided by the Adviser on completion of the Project work , students have to submit then work in the form of a dissertation followed by oral presentation in the presence of Faculty members and an external expert.

Laboratory Safety Equipments:

Part: I Personal Precautions:

1. All persons must wear safety Goggles at all times.
2. Must wear Lab Aprons/Lab Jacket and proper shoes.
3. Except in emergency, over – hurried activities is forbidden.
4. Fume cupboard must be used whenever necessary.
5. Eating, Drinking and Smoking in the laboratories strictly forbidden.

Part: II: Use of Safety and Emergency Equipments:

1. First aid Kits
2. Sand bucket
3. Fire extinguishers (dry chemical and carbon dioxide extinguishers)
4. Chemical Storage cabinet with proper ventilation
5. Material Safety Date sheets.
6. Management of Local exhaust systems and fume hoods.
7. Sign in register if using instruments.