ಮಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

MANGALORE UNIVERSITY

(Accredited by NAAC with 'A' Grade)

ಕ್ರಮಾಂಕ/No. MU/ACC/CR6/CBCS-PG(SLB)/2017-18/A2

ಕುಲಸಚಿವರ ಕಚೇರಿ
ಮಂಗಳಗಂಗೋತ್ರಿ - 574 199
ಕರ್ನಾಟಕ, ಇಂಡಿಯ
Office of the Registrar
Mangalagangothri - 574 199
Karnataka, India

ದಿನಾಂಕ/Date : 8/5/2017

NOTIFICATION

Sub: III & IV semester Choice Based Credit System syllabus of M.Sc. in Applied Chemistry degree programme.

Ref: 1) This office Notification No. MU/ACC/CR7/CBCS-PG(SLB)/ 2016-17/A2, dated: 17-8-2016.
2) Academic Council decision dated 3-2-2017 vide Agenda No. 3:11 (2016-17)

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In continuation to this office Notification cited under ref. (1) above, the syllabus of III & IV semester M.Sc. in Applied Chemistry degree programme which approved by the Academic Council at meeting held on 3-2-2017 is hereby notified for implementation with effect from the academic year 2017-18 and onwards (for students of 2016-17 batch and onwards).

REGISTRAR

To:

1) The Chairman of the Department concerned/ The Coordinator of the degree programme concerned.
2) The Principal of the college concerned.
3) The Registrar [Evaluation], Mangalore University.
4) The Chairman of the Board of Studies concerned.
5) The Superintendent [ACC], Office of the Registrar, Mangalore University.
6) Guard file.

Mangalore University

Department of Studies in Chemistry

M. Sc. Degree Programme

(CHOICE BASED CREDIT SYSTEM - SEMESTER SCHEME)

Syllabi for M.Sc., Course in

APPLIED CHEMISTRY

(From the Academic Year 2016-17 onwards)

Programme: M.Sc. in Applied Chemistry

1st semester **2nd Semester**

Course Code	Course Title	Course Code	Course Title
AC H 401	Inorganic Chemistry	AC H 451	Advanced Inorganic Chemistry
AC H 402	Organic Chemistry	AC H 452	Advanced Organic Chemistry
AC H 403	Physical Chemistry	AC H 453	Advanced Physical Chemistry
AC S 404 Or AC S 405	Inorganic Spectroscopy and Analytical Techniques Or Environmental Chemistry	AC S 454 Or AC S 455	Organic Spectroscopic Techniques Or Chemistry of Bio-molecules
AC E 406	Molecular Spectroscopy and Diffraction Techniques	AC E 456	Environmental, Electro- and Polymer Chemistry
AC P 407	Inorganic Chemistry Practicals-1	AC P 457	Inorganic Chemistry Practicals-II
AC P 408	Organic Chemistry Practicals-1	AC P 458	Organic Chemistry Practicals-II
AC P 409	Physical Chemistry Practicals-1	AC P 459	Physical Chemistry Practicals-II

3rd Semester **4th Semester**

AC H 501	Bioinorganic Chemistry	AC H 551	Coordination Chemistry
AC H 502	Synthetic Reagents and Heterocyclic Chemistry	AC H 552	Synthetic & Natural Product Chemistry
AC H 503	Polymers & Photo Chemistry	AC H 553	Solid State Chemistry & Nanomaterials
AC S 504 Or AC S 505S	Organometallic Chemistry Or Inorganic Photochemistry	AC S 554	Synthetic Polymers, Dyes and Pesticides
AC E 506	Analytical and Green Chemistry	AC S 555 Or AC S 556	Applied Electrochemistry Or Reaction Kinetics & Nuclear Chemistry
AC P 507	Inorganic Chemistry Practicals-III	AC P 557	Inorganic Chemistry Practicals-IV
AC P 508	Organic Chemistry Practicals-III	AC P 558	Physical Chemistry Practicals-IV
AC P 509	Physical Chemistry Practicals-III	AC P 559	Project Work & Dissertation

3rd SEMESTER

AC H 501 BIOINORGANIC CHEMISTRY

UNIT – I **[15Hours]**

Therapeutic uses of Metals - Metals in medicine: Metals and human biochemistry, general requirements. Disease due to metal deficiency and treatment: Iron, zinc, copper, sodium, potassium, magnesium, calcium and selenium .

Metal complexes as drugs and therapeutic agents: Antibacterial agents, antiviral agents, metal complexes in cancer therapy, metal complexes for the treatment of rheumatoid arthritis, vanadium in diabetes, metal complexes as radio diagnostic agents

Treatment of toxicity due to inorganics: General aspects of mechanism of metal ion toxicity, (i) Mechanism of antidote complex with poison, rendering it inert: arsenic, lead, mercury, iron, copper (ii) Antidote accelerated metabolic conversion of poison to non-toxic product: cyanide and carbon monoxide

UNIT -II: **[15 Hours]**

Metal ions in biological systems-essential and trace metals, ion transport across membranes, active transport of ions across biological membranes, ionophores .

Biological nitrogen fixation, Molybdenum nitrogenase Model compounds, in vitro fixation of nitrogen through dinitrogen complexes. Metal complexes in transmission of energy-chlorophylls. photosystems I ans II in cleavage of water, model systems.

UNIT-III: **[15Hours]**

Transport and storage of dioxygen- heme proteins, oxygen uptake, functions of haemoglobin, myoglobin, hemerythrin and hemocyanins, synthetic oxygen carriers .

Metal storage and transport – ferritin, transferrin and ceruloplasmin. Electron transfer proteins-cytochromes, iron-sulphur proteins. Metalloproteins as enzymes – carboxy peptidase, carbonic anhydrase, alcohol dehydrogenase, catalases, peroxidases, cytochrome P 450, superoxide dismutase, copper oxidases, vitamin B_{12} coenzyme.

References:

1. M.N.Hughes: Inorganic Chemistry of Biological Processes, (2nd edn.) Wiley, 1988.
2. I.Bertini. H.B.Gray, S.J.Lippard and J.S.Valentine: Bioinorganic Chemistry, Viva Books, 1998.
3. J.E Huheey, R.L.Keiter and A.L.Keiter: Inorganic Chemistry(4th edn),Addison Wesley, 2000.
4. K. Hussain Reddy, Bioinorganic Chemistry - New Age International Ltd. (2003).
5. R.W. Hay, Bioinorganic Chemistry - Ellis Horwood Ltd., (1984)
6. Asim K Das, Bioinorganic chemistry, Books & Allied (P) Ltd.

AC H 502: SYNTHETIC REAGENTS AND HETEROCYCLIC CHEMISTRY

UNIT- I: Reagents in Organic Synthesis-I **[15 Hours]**

Organometallic Reagents: Preparation and properties of Organolithium and organomagnesium compounds. Their uses in organic synthesis and in the preparation of Organometallic

compounds. Methods of preparation, properties, reactivity and reactions of Organozinc, Organocadmium, Organomercury and Organoindium reagents.

Silicon containing Reagents: Introduction, preparation reactions & stereochemistry, Peterson reaction.

Boron containing Reagents: Introduction, preparations, Hydroborations, reactions of Organoboranes- Isomerization, oxidation, protonolysis, carbonylation, cyanidation. Synthesis of esters, E and Z alkenes, conjugated dienes and alkynes.

Organotin Compounds: Synthesis of Organostannanes and their utility in C-C bond forming reactions. Barton decarboxylation reaction, Barton deoxygenation, Stelly-Kelly coupling reaction.

Palladium reagents: Heck and Negishi reaction.

UNIT- II: Reagents in Organic Synthesis-II [15 Hours]

Use of the following reagents in Organic synthesis and functional group transformation: Gillman's reagent, Lithium diisopropylamide (LDA), Dicyclohexyl carbodiimide (DCC), 1,3-dithiane (reactivity-umpolong), Trimethyl silyliodide, DDQ, Selenium dioxide, Wilkinsons catalyst, Phase transfer catalysts, Baker's yeast, polyphosphoric acid. Trimethyl silyl cyanide, hydrosilanes, Chloramine-T. Woodward and provost hydroxylation, Phase transfer catalyst and Crown ethers.

UNIT- II: Heterocyclic Chemistry [15 Hours]

Nomenclature of Heterocycles, Hantzsch-Widman system for monocyclic, fused and bridged heterocycles. Structure, synthesis and reactions of three membered heterocycles (aziridines, episulfides, diaziridines, oxazirines), four membered heterocycles (azetidines and thietanes), five membered heterocycles (furan, pyrrole, thiophene, oxazoles, imidazoles, thiazoles), six membered heterocycles (pyridine, Pyrimidine, α- and γ-Pyrones), seven membered heterocycles (Azepines, Oxepines, Thiepines) and fused hetercycles (Indoles, benzofurans, Quinolines, Isoquinolines, Coumarins, Purines).

References :-

1. Advanced Organic chemistry 5th edition -J. March (John Wiley and sons).
2. Organic Chemistry- J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford University Press).
3. E. Eliel and S.H. Wilen, Stereochemistry of Organic compounds, John Wiley.
4. Organic Spectroscopy- William Kemp(Palgrave)2005.
5. Advanced Organic Chemistry – Part A & B, 3rd edition- F.A. Carey and Sundberg, (Plenum Press) 1990.
6. Advanced General Organic Chemistry-S.K. Ghosh (Book and Alleied (P) Ltd) 1998.
7. Organic Synthesis, special Techniques -V.K. Ahluwalia and Renu Agrawal (Narosa Publications).
8. An Introduction to the Chemistry of Heterocyclic Compounds-Acheson (Wiley–Eastern) 1987.
9. Heterocyclic Chemistry-J. Joule & G. Smith (Van-Nostrand) 1978.
10. Heterocyclic Chemistry, 3rd Edition-Raj K. Bansal (New Age Inte rnational) 2005.
11. Organic Chemistry-P.Y. Bruice (Pearson Education, New Delhi) 2002.
12. Comprehensive Heterocyclic Chemistry Vol-I-VI Ed. Katritzky & Rees (Pergamon), 1984.

AC H 503: POLYMERS AND PHOTOCHEMISTRY

UNIT- I: **[15 Hours]**

Terminology and basic concepts: Monomers, Functionality, repeat units, degree of polymerization. General structure and naming of polymers.

Classification based on various considerations-source, preparation methods, thermal behavior, chain structure etc**.** Homopolymers and copolymers, Linear, branched and network polymers.

Techniques of polymerization: Techniques of preparation of addition and condensation polymers. **Kinetics of polymerization:** Kinetics of addition and condensation polymerization. Kinetics of copolymerization, reactivity ratio and composition of copolymers.

Expressions for average molecular weighs. Molecular weight distribution and Polydispersity**.**

Determination of molecular weight: Osmometry, viscometry, ultracentrifugation and GPC methods

UNIT- II: **[15 Hours]**

Stereochemistry of polymers: Geometric and optical isomerism in polymers. Structure, properties and preparation of stereoregular polymers.

Thermal Characterization: Glass Transition and melting-correlation with structure- Factors affecting Tg and Tm. Techniques of thermal characterization: DSC, DTA , DTG and TGA techniques.

Structural features, properties and uses of commercial polymers: Vinylic and acrylic polymers, polyesters, polyamides, polyurethanes , polycarbonates, phenolic and amino resins, and regenerated cellulose.

Properties and uses of Specialty polymers- Composites, Conducting polymers and Biomedical polymers.

Polymer processing Techniques - Compounding- role of additives. Casting, moulding , and spinning techniques. Plastic waste management techniques.

UNIT- III: **[15 Hours]**

Photochemistry: Introduction to photochemistry. Determiation of quantum yield- Actinometry. Frank-Condon principle and its implications in predicting shapes of absorption and emission spectra. Effect of solute solvent interactions on electronic spectra-spectral shifts.

Physicochemical properties of electronically excited molecules-excited state dipole moments, acidity constants. Flash photolysis technique.

Photophysical pathways- Jablonski diagram, Radiative and Radiationless transitions, selection rules. Photochemical kinetics of unimolecular and bimolecular processes. Quenching-collisions in the gas phase and in solution (Stern-Volmer equation). Photoisomerization, photo Fries rearrangement and Norrish type cleavage reactions with specific examples.

REFERENCES:-

1. Text book of Polymers- F.W.Billmeyer (Wiley)
2. Contemporary Polymer Chemistry-H.R. Allcock and F.W. Lampe (Prentice Hall).
3. Polymer Science and Technology-J.R. Frird (Prentice Hall).
4. Polymer Science: V.R. Gowariker, N.V.Viswanathan & T.Sreedhar.
5. Principles of Polymer Science- P.Bahadur and N.V.Sastry (Narosa Publishers) .

6. Fundamentals of Photochemistry – Rohatgi and Mukherje (New Age Bangalore), 2000.
7. Physical Chemistry, 5th Ed., - Atkins (ELBS) 1995.
8. Photochemistry-Gurdeep Raj, Goel Publishing House, 2nd Edition, 1991.
9. Photochemistry, Carol E Wayne & Richard P. Wayne, Oxford Univ Press, , 1996

AC S 504: ORGANOMETALLIC CHEMISTRY

UNIT- I: [12 Hours]

Historical development- classification and nomenclature, bond energies and stability. 16- and 18-electron rules. Transition metal alkyls and aryls- types, routes of synthesis, stability and decomposition pathways,. Nucleophilic and electrophilic cleavage of metal-carbon sigma bonded compounds. Alkane activation.

Transition metal to carbon multiple-bonded compounds- carbenes, carbynes, synthesis, nature of bond, agostic interactions, structural characteristics and reactivity. Transition metal hydrides – synthetic routes, properties, structure and reactivity, synthetic applications.

UNIT-II: [12 hours]

Transition metal-carbon pi complexes: Preparative methods, nature of bonding, structural features of olefinic, acetylenic, allylic, butadiene, cyclobutadiene, η^5- cyclopentadienyl, η^6-benzene and other arenes, cycloheptatriene and cyclooctatetraene complexes. Important reactions relating to nucleophilic and electrophilic attack on ligands. Fluxional isomerism in olefin, allyl, dienyl and cyclopentadienyl complexes. Carbene complexes and metallacycles, arene complexes. Isolobal concept.

UNIT- III: [12 hours]

Catalysis by organometallic compounds: oxidative addition, insertion, deinsertion and reductive elimination reactions.

Homogeneous catalysis by organometallics- hydrogenation, hydrosilation, hydrocyanation and isomerization of olefins, immobilisation of homogeneous hydrogenation catalysts,

Hydrocarbonylation of olefins (oxo reaction–cobalt and rhodium oxo catalysts), Wacker process. Carbonylation of alcohols- Monsanto acetic acid process. Polymerization of olefins and acetylenes: Ziegler-Natta catalyst systems. Fischer – Tropsch reaction , Water Gas Shift reactions.

References:

1. J.P.Collman, L.S.hegedus, J.R.Norton and R.G.Finke: Principles and Applications of
2.Organotransition Metal Chemistry, University Science Books, 1987.
3. R.C.Mehrotra and A.Singh: Organometallic Chemistry, New Age International, 1999.
4. R.H.Crabtree:Organometallic Chemistry of Transition Metals, Wiley , 1999.
5. F.A.Cotton and G.Wilkinson : Advanced Inorganic Chemistry, Wiley, 1991.
6. Organometallic Chemistry, G. S. Sodhi, Ane books Pvt Ltd Edition 2009.

AC S 505: INORGANIC PHOTOCHEMISTRY

UNIT – I **(12 Hrs.)**

Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times- measurements of the times. Flash photolysis, stopped flow techniques. Energy dissipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages – primary and secondary processes. Properties of Excited States: Structure, dipole moment, acid-base strengths, reactivity

UNIT – II **(12 Hrs.)**

Excited states of metal complexes: comparison with organic compounds, electronically excited states of metal complexes, charge-transfer spectra, charge transfer excitations methods for obtaining charge-transfer spectra. Liquid Field Photochemistry Photosubstitution, photooxidation and photoreduction, lability and selectivity, zero vibrational levels of ground state and excited state, energy content of excited state, zero-zero spectroscopic energy, development of the equations for redox potentials of the excited states.

UNIT – III **(12 Hrs.)**

Energy transfer under conditions of weak interaction and strong interaction-exciplex formation; Conditions of the excited states to be useful as redox reactions, excited electron transfer, metal complexes as attractive candidates (2,2'-bipyridinie and 1, 10-phenonthrolin complexes:. Illustration of reducing and oxidizing character of Ruthenium^{2+}(bipyridyl complex, comparison with Fe(bipy)s: role of spin-orbit coupling-life time of these complexes. Application of redox processes of electronically excited sates for catalytic purposes.

References:

1. A.W. Adamson and P.D. Fleischauer-concepts of Inorganic Photochemistry, Wiley
2.Inorganic Photochemistry, J.Chem.Educ., vol.60, no.10, 1983.
3.Progress in Inorganic Chemistry, vol.30, Ed.S.J.Lippard, Wiley.
4.oordination Chem.Revs., 1981, vol 39:121, 131;1975, 15:321, 1990, 97:313.
V. Balzari and V. Carassiti, Photochemistry of Coordination Compounds, Academic.
5. G.J.Ferraudi, Elements of Inorganic Photochemistry, Wiley

CH E 506 : ANALYTICAL AND GREEN CHEMISTYRY

UNIT- I: **[12 Hours]**

UV/Electronic Spectroscopy: Basic principles, Beer-Lambert law, types of absorption bands, Factors affecting the positions of UV bands. Theoretical prediction of λmax for polyenes, α,β-unsaturated aldehydes, ketones (Woodward-Fieser rules) and substituted benzenes.

IR Spectroscopy: Basic principles, Application of infrared spectroscopy in the structural study-identity by finger printing and identification of functional groups. Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines). Study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides and acids). Factors affecting band positions and intensities

Nuclear Magnetic Resonance Spectroscopy: Basic principles, Solvents used, chemical shift and its measurements, factors affecting chemical shift. Integration of NMR signals, spin-spin coupling, coupling constant. Shielding and deshielding. High resolution ^{1}H NMR. Applications of NMR spectroscopy in structure elucidation of simple organic molecules.
Mass Spectrometry: Basic principles, molecular ions, meta-stable ions and isotope ions. Fragmentation processes, McLafferty rearrangement. retro Diels-Alder fragmentations. Nitrogen rule.

UNIT- II: [12 Hours]
Hydrologic cycle, sources, chemistry of sea water, criteria and standards of water quality- safe drinking water, maximum contamination levels of inorganic and organic chemicals, radiological contaminants, turbidity, microbial contaminants. Public health significance and measurement of colour, turbidity, total solids, acidity, alkalinity, hardness, chloride, residual chlorine, sulphate, fluoride, phosphate and different forms of nitrogen in natural and polluted water. Chemical sources of taste and odour, treatment for their removal, sampling and monitoring techniques. Determination and significance of DO, BOD ,COD and TOC. Water purification for drinking and industrial purposes, disinfection techniques, demineralization, desalination processes and reverse osmosis . Treatment of liquid radioactive wastes

UNIT- III: [12 Hours]
Green Chemistry: Definition and principles, planning a green synthesis in a chemical laboratory, Green preparation-Aqueous phase reactions, solid state (solventless) reactions, photochemical reactions, Phase transfer catalyst catalysed reactions (Quaternary ammonium salts & Crown ethers), enzymatic transformations & reactions in ionic liquids.
Sonochemistry: Introduction, instrumentation, the phenomenon of cavitation, Sonochemical esterification, substitution, addition, oxidation, reduction and coupling reactions.
Microwave induced organic synthesis: Introduction, reaction vessel and reaction medium, concept, specific effect, atom efficiency, % atom utilisation, advantages and limitations, alkylation of active methylene compounds, N-alkylation, condensation of active methylene compounds with aldehydes, Diels-Alder reaction, Leuckardt reductive amination of ketones, ortho ester Claisen rearrangement.

References:-

1. Organic Spectroscopy-3rd Ed.-W.Kemp (Pagrave Publishers, New York), 1991.
2. Spectrometric Identification of Organic Compounds - Silverstein, Bassler & Monnill (Wiley)1981.
3. Applications of Absorption Spectroscopy of Organic Compounds-Dyer(Prentice Hall,NY) 1965.
4. Spectroscopy of Organic Compounds-3rd Ed.-P.S.Kalsi (New Age, New Delhi) 2000.
5. Spectroscopic Methods in Organic Chemistry - Williams and Fleming, TMH.
6. A.K. De : Environmental Chemistry, (Wiley Eastern).
7. S.K.Banerji : Environmental Chemistry, (Prentice Hall India), 1993.
8 S.D. Faust and O.M. Aly : Chemistry of Water Treatment, (Butterworths),1983.
9. Sawyer and McCarty, Chemistry for Environmental Engineering(McGraw Hill) 1978
10. I.Williams, Environmental Chemistry, John Wiley, 2001.
11. S.M.Khopkar, Environmental Pollution Analysis, (Wiley Eastern).

12. Organic Synthesis-Special Techniques, V.K.Ahluwalia & R. Aggarwal, Narosa, 2001.
13. Green Chemistry-Environment friendly alternatives- R.Sanghi & M.M.Srivatsava, Narosa, 2003. 14. Green Chemistry-Environment benign reactions- V.K.Ahluwalia, Ane Books India, 2006.

AC P 507: INORGANIC CHEMISTRY PRACTICALS

1. Analysis of brass–Cu gravimetrically using ∝-Benzoinoxime & Zn complexometrically.
2. Analysis Cu-Ni alloy .
3. Analysis of Stainless Steel – Insoluble residue by gravimetry, Ni gravimetrically using DMG, Fe volumetrically using Ce(IV) & Cr volumetrically by persulphate oxidation.
4. Analysis of Type metal –Sn gravimetrically, Pb electrogravimetrically and Sb titrimetrically using $KBrO_3$
5. Quantitative analysis of the constituents & mixtures containing the following radicals.
(i) Cu(II) + Fe(II) - Cu gravimetrically as CuSCN and Fe using Ce(IV).
(ii) Fe(II) + Ni(II) – Fe gravimetrically as Fe_2O_3 and Ni using EDTA.
(iii) Fe(III) + Ca(II) - Fe gravimetrically as Fe_2O_3 and Ca using EDTA.
(iv) Cr(III) + Fe(III) – Using EDTA by Kinetic masking method.
6. Analysis of chalcopyrites, magnetite and ilmenite.
7. Ion-exchange chromatography: Separation and determination of Mg^{2+} / Zn^{2+}, Zn^{2+} /Cd^{2+}; Cl^-/ Br^- 8. Separation of cations using column and paper chromatography
9. Determination of the ion exchange capacity of a resin

References:-

1. A.I. Vogel : A Text book of Quantitative Inorganic Analysis, (ELBS), 1978.
2. I. M. Kolthof and E.P. Sandell: Quantitative Chemical Analysis.McMillan,1980.
3. Lobinski and Marczenko, Comprehensive Analytical Chemistry, Vol.30, Elsevier,1996.

AC P 508: Organic Chemistry Practicals - III

Quantitative Determination: of sugars, amino acids, phenols, amines by various methods. Determinations of acid & ester and acid & amide in the given mixtures.
Multi Step Organic Synthesis: Synthesis of Ethyl resorcinol from Resorcinol, ε-Caprolactam from cyclohexanone, p-Amionobenzoic acid from p-Nitrotoludine, s-Tribromobenzene from aniline, Benzanilide from Benzophenone, Benzylic acid from Benzoin, 2,5-Dihydroxy acetophenone from Hydroquinone, 2,4-Dinitrophenylhydrazine from Chlorobenzene, m-Nitrobenzoic acid from Benzoic acid, 2,4-Dinitrophenol from Chlorobenzene, o-Aminobenzoic acid from Phthalic anhydride .
Separation Techniques: Separation of components from mixture of organic compounds by fractional crystallization, fractional distillation, adsorption, Paper and TLC. Their purification and characterization.
Applications of computers in the study of conformation and geometry of some simple organic molecules.

References:

1. Elementary Practical Organic Chemistry-Vol. III quantitative Organic Analysis- A.I. Vogel
2. Experimental Organic Chemistry- Vol. I &II- P.R.Singh, Tata McGraw-Hill, 1981.
3.Practical Organic Chemistry- IV Ed- Dey &.Sitaraman (Allied)
4. Laboratory Experiments in Organic Chemistry-Adam, Johnson & Wicon(McMillan, London), 1979.
5. Experimental Organic Chemistry- H.D.Durst & G.E.Goke (McGraw-Hill)1980.
6. Computers and their applications to Chemistry, Ramesh Kumari (Narosa).
7. Short Manual to the Chemical Drawing Program-ChemDraw®- Stefan Bienz (CambridgeSoft).

AC P 509: PHYSICAL CHEMISTRY PRACTICALS - III

A. Kinetics and Catalysis (Any FOUR of the following reaction systems to be studied)
(Determination of reaction order and activation parameters, study of salt/solvent/catalytic effects and formulation of reaction scheme and deduction of rate laws).

1. Kinetics of acid catalysed hydrolysis of methyl acetate.
2. Saponification of ethyl acetate by conductivity method.
3. Reaction between potassium persulphate and potassium iodide (including the study of salt effect, dielectric constant effect and catalysis by Ag^{+}/ Fe^{2+} / Cu^{2+} ions).
4. Decomposition of diacetone alcohol by NaOH.
5. Kinetics of (i) Reaction between iodine and acetone and (ii) iodination of aniline.
6. Decomposition of H_2O_2 (including the study of catalytic effect).
7. Reaction between Chromic acid and oxalic acid.
8. Heterogeneous decomposition of ammonia.
9. Surface tension-concentration correlation for solutions (Gibbs equation).
10.Determination of activity of surfaces , free volume of catalysts and surface area of catalysts.

B. Thermodynamics Experiments (**Any Four experiments to be carried out)**

1. Determination of activities of an electrolyte and non – electrolyte by cryoscopy.
2. Determination of partial molar volumes of (a) Salts – water and (b) alcohol – water (methanol & ethanol) systems by density method.
3. Determination of specific heat of liquids and solutions by calorimetry.
4. Cryoscopic and ebullioscopic analysis of the given mixture of urea and glucose.
5. Study of adsorption of picric acid on charcoal using a calorimeter,

C. Spectrophotometry (Any Two experiments are to be carried out)

1. Determination of pKa values of indicators.
2. Determination of Hammett's acidity function.
3. Spectroscopic investigation of partition coefficient of iodine between H_2O and $CHCl_3$.
4. Study of the effect of ionic strength on the pH of the given acid with the help of indicators using buffer solution by colorimetric method.
5. Determinationmof composition and stability consatant of metal complexes by (Fe^{3+} anD salislic acid, Ni (II) and 1,10 phenanthroline).
6. Simultaneous determination of Manganese and chromium in a solution of dichromate and permanganate mixture

References:-

1. Willard, Merrit, Dean & Settle:Instrumental Methods of analysis(Van Nostrand.NY)1981.
2. Sawyer and Roberts : Experimental Electrochemistry for Chemists (Wiley , N.Y)1974.
3. B.P.Levitt : Findlay's Practical Physical Chemistry, (Longman, London), 1973.
4. J. B. Yadav : Advanced Physical Chemistry Experiments (Goel Publishing House), 1988.
5. F. J. Welcher(Ed): Standard methods of Chemical Analysis (Kriegen, N.Y)1975.

4th SEMESTER

AC H 551: COORDINATION CHEMISTRY

UNIT- I: **[15 Hours]**

Spectral properties of complexes: Term symbols for d^n ions, spectroscopic ground states, selection rules, nature of spectral bands- band shapes, band intensities, band widths, spin-orbit coupling, vibrational structures.

Orgel diagrams, Tanabe-Sugano diagrams, interpretation of spectra of octahedral, distorted octahedral, tetrahedral and square planar complexes, Determination of Δ_o from spectra. Charge transfer bands – origin, types, and characteristics. Photochemistry of metal complexes- photosubstitution and photoredox reactions, ligand photoredox reactions, photoreactions and solar energy conversion.

UNIT- II: **[15 Hours]**

Type of magnetic behaviour, orbital contribution, spin orbit coupling, spin cross-over systems. Measurement of magnetic susceptibility – Gouy and Faraday methods, diamagnetic corrections, ferro- and antiferromagnetic coupling, super paramagnetism. High and low spin equilibria. Magnetic properties of lanthanides and actinides. Infrared spectra of metal complexes, Group frequency concept. Changes in ligand vibrations on coordination- metal ligand vibrations. Spectral applications of coordination compounds - IR spectra of metal carbonyls - ESR spectra- application to copper complexes, Mossbauer spectra- application to iron complexes. NMR spectra - Application to diamagnetic complexes.

UNIT- III: **[15 Hours]**

Reaction Mechanisms in Transition Metal Complexes**:** Energy profile of a reaction, inert and labile complexes, kinetics of octahedral substitution and mechanistic aspects. Acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism and evidences in its favor. Anation reactions, reactions without M-L bond cleavage. Substitution reactions in square planar complexes, trans effect, mechanisms of substitution. Substitution reactions in tetrahedral complexes. Isomerization and racemization reactions of coordination compounds. Electron transfer reactions- inner sphere and outer sphere reactions, complimentary and non-complimentary reactions.

References:

1. D.N.Satyanarayana:Electronic absorption Spectroscopy and Related Techniques, OUP, 2001.
2. F.Basolo and R.G.Pearson: Inorganic Reaction Mechanisms, Wiley Eastern, 1979.
3. W.W.Porterfield: Inorganic chemistry – A Unified Approach, Elsevier, 2005.
4. R.L.Dutta and A Syamal : Elements of Magnetochemistry, Affiliated east-West, 1993.
5. J.E Huheey, R.L.Keiter and A.L.Keiter: Inorganic Chemistry(4^{th} edn),Addison Wesley, 2000.

AC H 552: Synthetic and Natural Products Chemistry

UNIT–I: **[15Hours]**

Reduction Reactions: Catalytic hydrogenation-Introduction, catalysts and solvents, mechanisms and stereochemistry of catalytic hydrogenations. Hydrogenolysis and homogeneous catalytic hydrogenation.

Metal hydride reduction: Reduction with $LiAlH_4$ and $NaBH_4$, Stereo chemistry of reduction, Reduction with diborane and related reactions.
Dissolving Metal Reductions: Mechanisms of reduction of carbonyl compounds, Bimolecular reductions of esters, Birch reduction, Wolf-Kishner reduction and reduction with diimide.
Oxidation reactions: Mechanism of oxidation reaction with chromium and manganese salts, Osmium tetroxide, peracids, periodic acid and Lead tetra acetate.
Halogenation: Halogenation of carbonyl compounds. Benzyllic and Allylic halogenations.

UNIT –II: [15 Hours]
Alkaloids: Introduction of isolation, classification, general methods of structure illucidation. Structure and synthesis of the following alkaloids: Papaverine, Adrenaline, Ephedrine, Piperine, Morphine, Yohimbine, Reserpine.
Terpenoids: Introduction, classification, isoprene rule, methods of structure determination. Structure and synthesis of Geraniol, Menthol, α-Pinene, Camphor, Farnesol, Zingiberene and α-Santonin.
UNIT- III: [15 Hours]
Steroids: Introduction and Nomenclature of steroids, Blanc's rule, Barbier-Wieland degradation, Oppenauer oxidation, Diel's hydrocarbon, Chemistry of Cholestrol, Ergosterol, Vitamin-D & bile acids.
Steroidal Hormones: Chemistry of Oestrone, Oestradiol, Oestriol and their chemical relationship. Chemistry of Progesterone, Androsterone and Testosterone. Structure and Synthesis of Cortisone, Cortisol and Aldosterone. Steroidal oral contraceptives. Transformations in steroids and hormones.

References:

1. Modern Organic Reactions- H.O.House.
2. Advanced Organic Chemistry-IV-Ed. Part A &B-F.J.Carrey & R.J.Sundberg(Kluwer) 2001.
3. Modern Methods of Organic Synthesis-N.Carruthers (Cambridge University), 1996.
4. Natural Products Chemistry Vol-I & II. G. R. Chatwal (Himalaya Bombay) 1990.
5. Chemistry of Natural Products – Vol-I & II – O. P. Agarwal(Goel Gorakhpur), 1985.
6. Organic Chemistry-Vol-I & II- I. L. Finar (Longmann ELBS London), 2000.
7. Chemistry of Natural Products: A Unified Approach-N R Krishnaswamy (University Press) 1999.
8. Chemistry of Natural Products-Sujata V. Bhat, B.A. Nagasampagi, Meenakshi Sivakumar (Springer-Narosa) 2005.

AC H 553: CHEMISTRY OF SOLID STATE AND NANO MATERIALS

UNIT-I: [15 Hours]
Surface morphology: Structure of solid surfaces and adsorbed layers. Mechanism of surface reactions. Study of surface morphology (LEED. AFS and SEM) .
Crystal Defects and Non-Stoichiometry: Perfect and imperfect crystals, intrinsic and extrinsic defects- point, line and plane defects. Vacancy, Schottky and Frenkel defects. Thermodynamics

of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects – Structures of UO_2, FeO and TiO .

Solid State Reactions: General Principles, Wagner's theory. Order - disorder transitions in solids- Bragg- William's theory Mechanism of diffusion , Kirkendall effect

Preparative Methods: Ceramic, sol-gel, precursor and chemical vapour deposition (CVD) methods. Nucleation & crystal growth techniques-pulling, zoning, flame fusion & skull melting. Basic methods of preparation of thin films .

UNIT – II : [15 Hours]

Ionic Conductors: Types of ionic conductors, mechanism of ionic conduction, diffusion superionic conductors; phase transitions and mechanism of conduction in superionic conductors, examples- β-alumina, AgI, halide and oxide ion conductors. 4 hrs

Superconductivity: Meisner effects; Types I and II superconductors, Features of superconductor, isotope effect, high T_c materials. Principle of low temperature superconductivity. 4 hrs

Liquid Crystals: Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases; smectic – nematic transition and clearing temperature- homeotropic, planar & schlieren textures, twisted nematics chiral nematics, molecular arrangements in smectic A and C phases. Optical properties of liquid crystals 4hrs.

Magnetic properties: Classification of magnetic materials – dia, para, ferro, ferri, antiferro & antiferri magnetic types Langevin diamagnetism. Selected magnetic materials such as spinels & garnets. 3 hrs

UNIT-III: [15 Hours]

Nano Materials :Introduction, Definition and terminology, consequences of the nanoscale (Nanoparticle, Morphology, Geometric structure, Electronic structure, Optical properties), Nanolayers, Carbon nanotubes, Nanowires, Quantum dots.
Nanotechnology and its business applications, Introduction to nanoscale, Potential applications of nanomaterials, Challenges and opportunities scope of nanotechnology, Commercialization scope Nanotechnology research in 21st century, Basic nanotechnology science and chemistry concepts, basic nanostructures , nanocomposites, Thin films, nanofoam, nanoclusters, smart nanostructures, manufacturing techniques of nanomaterials. 7 hrs.
Supra Molecular Chemistry Introduction, Cryptands, Cyclophanes, Crown ether, Calixerenes, Cyclodextrines, Molecular self assembly: Catenens and Rotaxenes, Supramolecular reactivity and catalysis, Supramolecular devices. 4hrs

Pharmaco kinetics: Introduction, Plasma concentration - time curve, protein binding and drugs, drug dissolution rate, pharmacokinetics applied to one compartment open model (calculation of elimination rate constant & metabolism constant). 4 hrs.

References:

1. Solid state Chemistry, D. K. Chakrabarty (New Age) 1996.
2. Principles of the solid state, H.V.Keer (Wiley Eastern) 1993.
3. Solid state chemistry and its applications, A.R.West (Wiley) 1984.
4. L.Smart and E. Moore, Solid State Chemistry –An Introduction (Chapman &Hall)1992.
5 V. Raghavan, Material science and Engineering (3rd Ed), (Prentice Hall India)1993.
6. Thermotropic Liquid Crystals, Ed. G.W. Gray, Wiley.
7. S.Chandrasekhar, Liquid Crystals, Cambridge University Press (2nd ed), 1994.
8. Basics of Nano Chemistry, Mamta V Sachdeva, Anmol Publishers, New Dlhi. 2011.
9. Modern heterogeneous Oxidation Catalysis, Wd.Noritaka Miguno, Wiley, Weinheim, 2009.

10.Nanoscale materials, Ed-L.M.Liz-Marzan and P.V.Kamath (Kulwer), 2003.
11. Introduction to Nanotechnology, C P Poole and F J Owens (Wiley Intersci), 2006.
12. Introduction to Petrochemicals, Sukumar Maiti (Oxford & IBH, Delhi), 1992.

AC S 554: Synthetic Polymers, Dyes and Pesticides

UNIT–I: [12 Hours]

Synthetic polymers: Classification and Nomenclature. Methods of polymerization, Mechanism and Stereochemistry, Addition polymerization (Anionic, Cationic and Free radical process), Condensation and Stepwise polymerization, Coordination polymerization, Ring opening polymerization. Mechanism of co polymerization. Properties, Structure and applications of Polythene, Polypropylene, PVC, Polystyrene & Acrylic polymers, Teflon, polyesters, polyamides, Phenol-Formaldehyde resins, Urea-Formaldehyde resins, Epoxy resins, Polyurethanes, Polycarbonates, Synthetic rubber. Structural features and manufacture of natural rubber and Regenerated cellulose. Ziegler-Natta catalyst.

UNIT -II : [12 Hours]

Dyes: Introduction, modern theories of colour and chemical constitution. Classification of dyes, methods of applying dyes to the fabrics. A general study of Azo dyes- Orange –II, rosanthrene O, Naphthol blue black 6B, Mordant brown, Congo red, Methyl orange, Chrysoidin G, Bismark brown.

Triphenylmethane dyes- Malachite green, Rosaniline, Crystal violet and Phenolphthalein; Cyanin dyes- Ethyl Red, Cyanin blue and Quinaldine, Reactive dyes and Optical brighteners- Tinapal and Blankophor.

Pigments: Fast violet, Lake red and Orange R.

UNIT - III : [12 Hours]

Insecticides: Introduction, classification, mode of action and synthesis of Methoxychlor, chlordane, heptachlor, Hexachlorocyclohexane, Parathion, Diazenon, Sevin and Beygon. Naturally occurring insecticides-pyrethroids-natural pyrethrins-isolation and structures, synthetic pyrethroids.

Insect Pheromones: Introduction, use in insect pest control. Synthesis of disparlure, grandisol and bomykol.

Fungicides: Introduction, Systemic fungicides-types & examples.

Herbicides: Introduction, study of sulfonyl ureas and heterocyclic sulphonamides.

Fumigants and repellants. Mechanism of action and toxicities of insecticides, fungicides and herbicides.

References

1. Polymer Science- V.R.Gowariker, N.V.Vishwanathan & T.Shridhar (Wiley Eastern) 2008.
2. Textbook of Polymer Science, 3rd Edition, Fred W. Billmeyer (Wiley) 1984.
3. A Textbook of Synthetic Dyes- O.D. Tyagi & M. Yadav (Anmol Publications) 2002.
4. Textbook of Dyes - A. Arora (Sonali Publications) 2009.
5. Synthetic Dyes – Vol-I – Venkataraman, 1999.
6. Synthesis and Chemistry of Agrochemicals, Vol I & II, ACS, Wahington.

7. Chemicals for Crop Protection and Pest Managements, M B Green, G.S. Hartley West, Pergamon.
8. Chemistry of Insecticides and Fungicides, Sree Ramulu, Oxford & IBH, 1985.

AC S 555: APPLIED ELECTROCHEMISTRY

UNIT-I : [12 Hours]

Electrochemical Energy System: Electricity storage-Importance, storage density, Fundamentals and classification of batteries, Primary battery (Laclanche-dry cell and Alkaline cell). Secondary battery (acid and alkaline). Reserve batteries. Lithium batteries - (primary and secondary and lithium based conducting polymer battery). Fuel cells – introduction, classification, H_2-O_2 and bio-cells. 5hrs

Bio-electrochemistry- Introduction, Membrane potential - theoretical and modern approach. Electrical conduction in biological organism, Electrochemical communication in biological organisms. **3hrs**

Sensors: Biosensors: Introduction electrochemical bio-sensors- characteristics, use as a transducer, types. **Ion-Sensors**: Ion-selective electrode: Introduction, Types. Analytical and biological applications of sensors. 4hrs

UNIT-II : [12 Hours]

Metallurgical Processing: Electroplating-fundamentals, mechanism of electrodeposition of metals, application of electroplating. Brief account of Electroless plating, Conversion coatings, Electrophoretic painting.

Metals and materials processing-theory and applications of Electroforming and Electrochemical etching. Production of metals by electro winning and electrorefining.

Electrochemistry of Environment: Introduction, Global warming. Electrochemistry in - transport system, fixing of CO_2, sewage disposal, treatment of waste, Metal ion removal and metal recovery. Treatment of liquors containing dissolved chromium.

UNIT-III: [12 Hours]

Electrochemical Engineering: General considerations, costing and technology of electrolytic process, electrolysis parameters, principles of cell design, laboratory data and scale-up, performance and figures of merit. 4hrs

Industrial Electrochemistry: Fundamentals, electro- organic synthesis (Kolbes synthesis, oxidation and reduction of hydrocarbons, reduction of nitro-compounds); Electro inorganic synthesis of fluorine and ozone. Synthesis of metal salts via anodic dissolution 4hrs.

Industrial Application- A Case study:- The chlor-alkaly industry: Introduction, General concepts of brine elecrolysis, modern technological developments (electrode materials, membrane), chlorine cell technologies (diaphragm cells, membrane cell). 4hr

References:

1. Modern Electrochemistry, 2nd Ed. Vol.1,2A &2B, Bockris & Reddy (Plenum, NY) 1998
2. Chemical &Electrochemical Energy Systems, R. Narayan & B. Viswanathan (University Press), 1998.
3. Industrial Electrochemistry, D. Peltcher & F. C. Walsh (Chapman & Hall)1990.
4. Biosensors-theory and Applications, Donald G. Burek, (Technomic), 1993.
5. Principles and Applications of Electrochemistry–Crow (Chapman hall, New York) 2014
6. Fundamentals of Electrochemistry, Fulkner and A. J. Bard, Wiley India, 2006.

AC S 556: REACTION KINETICS & NUCLEAR CHEMISTRY

UNIT- 1 **[12 Hours]**

Rates of Chemical Reactions: Feasibility of reaction, why kinetic studies, mechanism of reactions, practical measurements, rate expression. Experimental methods: Introduction, open and closed system, methods for following the progress of the reaction (physical, optical, chromatography, electrochemical, chromatography, NMR, ESR), Analysis of results. Choice of an equation to represent the results. 8hrs

Application of Chemical kinetics in the elucidation of mechanisms of some Inorganic organic reactions- co ordinate complexes, ketonisation of acids in oxide catalysis. Non-kinetic methods of determining mechanisms.

UNIT II **[12Hours]**

Reaction at electrode surface: Introduction, electrode double layer at Interface, different aspects of electrochemical reactions, general approach to th elucidation of the electrode reaction, effect of adsorption of ions on the electrode surface on the rate of electrode reaction. Study of some inorganic and organic composite reactions (decomposition of Phosgene, Nitogen pentoxide, , Ozone, Ethane, acetaldehyde and hydrogen-oxygen reaction) 8hrs

Potential energy surfaces, evaluation of activation energy. Futures of PE surfaces-attractive and Repulsive surfaces for Exothrmic reactions, Surfaces of intermediates type reactions, selective enhancement of reaction. 4hrs

UNIT III **[12 hours]**

Radioactivity and Nuclear Decay – Nuclear stability-Liquid drop, shell and collective models Decay modes of natural and artificial nuclides- Determination of half life, growth kinetics. Conditions of equilibrium. Theories of $\propto$, $\beta$and γ emissions. 4 hrs.

Radiation Detection and Measurement: Experimental techniques in the assay of radioactive isotopes. Radiation Detectors-ionisation chambers, proportional and Geiger-Muller, scintillation and semiconductor radiation detectors (NaI-Tl and Ge(Li), HPGe solid state detectors). Liquid scintillators and multichannel analysers. 4 hrs.

Nuclear Reactions, Energy and Nuclear Power reactors - Nuclear fission and fusion. Types of nuclear power reactors, basic features and components of a nuclear power reactor. An introduction to breeder reactors 4hrs

References:

1. Chemical Kinetics, K. J. Laidler, Pearson Education, Anand Sons(India) 3rd ed., 2008.
2. Fundamentals of Chemical Kinetics, M. R.Wright, Harwood Publishing, Chichesrer, 1999.
3. Kinetics & Mechanisms of Chemical Transformations, J Rajaram & J C Kuriacose, Macmillan, Delhi, 2007 .
4. Nuclear and Radiation Chemistry –Friedlander, Kennedy Macias & Miller (Wiley) 1981.
5. Essentials of Nuclear Chemistry- H.J.Arnikar (Wiley Eastern) 1987.

ACP 557: INORGANIC CHEMISTRY PRACTICALS -IV

1. Determination of COD of a water sample,
2. Determination of dissolved oxygen (DO) by Winkler's method
3. Determination of nitrate & nitrite in water samples and sea water.
4. Analysis of heavy metals in waste water, sea water (Pb, Hg etc. By spectrophotometry)
5. Determination of available K in soil, 6. Determination of organic carbon in soil samples
7. Nephelometric determination of sulphate / phosphate.

8. Determination of alkalinity of water samples
9. Determination of fluoride in drinking water by spectrophotometry & ion selective electrode
10. Determination of phosphoric acid content in soft drinks
11 Spectrophotometric determination of sulphur and phosphorus present in soil.
12. Determination of phosphates in detergents
13. Any other experiment of interest.

REFERENCES:

1. A..I. Vogel : A Text book of Quantitative Inorganic Analysis, (ELBS), 1978.
2. APHA, AWWA and WPCF: Standard Method for the Examination of water and Waste Water (Washington DC),1989,
3. I. M. Kolthof and E.P. Sandell: Quantitative Chemical Analysis.McMillan,1980
4. I.Williams, Environmental Chemistry, Wiley, 2001
5. Lobinski and Marczenko, Comprehensive Analytical Chemistry, Vol.30, Elsevier,1996.

AC P 558: PHYSICAL CHEMISTRY PRACTICALS IV

A. Electrochemistry : (**Any EIGHT experiments are to be carried out**).

1. (a) Determination of transport number of Cd^{2+} and SO_4^{2-} ions by EMF method.
2. Electroplating of (i)Nickel, (ii)Chromium,(iii) Aluminum and iv)copper on a copper plate.
3. Verification of Tafel equation of hydrogen evolution reaction.
4. . Study of rate of corrosion and inhibition efficiency of an inhibitor on mild steel/Al/Cu by weight loss method i) at different time intervals and ii) at different temperatures(to evaluate thermodynamic parameters)
5. (a) Identification of deposites by chemical spot tests.
   (b) Determination of electrochemical equivalent of copper.
6. (a) Identification of metal ions in a mixture polarographically.
   (b) Qualitative determination of electroreducible substances of (i)lead ion with dichromate & (ii)ferric ion with titanous ion and (c) Verification of Ilkovic equation.
6. Determination of (i) stability constant of a metal complex (lead oxalate or copper glycinate) and (ii) concentration of metal ions polarographically.
7. Kinetics of corrosion of mild steel and accelerated corrosion resistance tests.
8. Electrolytic preparation- peroxydisulphate, chlorate and perchlorate, calcium gluconate & tetrachloroquinine.
9. Potentiometric titration of (a) Non aqueous sytem and (b) mixture of strong (HCl) and weak (HAC) acid with NaOH / NH4OH and find the strength of the acids in mixture.
10. Determination of decomposition potential of an aqueous electrolytic solution.
11. Determination of the potential of an electrochemical cell and mean ionic activity coefficient.
12. Determination of acidic and basic dissociation constants and isoelectric point an amino acid pH metrically..
13. pH titration of (a) HCl versus NaOH, (b) $CuSO_4$ versus NaOH and (c) HOAC versus NaOH and (d) lead nitrate versus potassium chromate, Titration of mixture of bases (Na_2CO_3 & $NaHCO_3$) with standard HCl and find the concentration of bases.
14. Determination of activity coefficient of an electrolyte at different molalities.

B. Polymers : (Any FOUR experiments to be carried out).

1. Preparation of polymers by condensation and free radical methods.
2. Study of kinetics of polymerization,
3. Thermal analysis of polymers.
4. Analysis of phenol-formaldehyde reaction products by TLC

5. Measurement of stress relaxation, creep & recovery of typical elastomers& plastics
6. Determination of molecular weight and size parameters of polymers by viscometry and turbidimetry.
7.Determination of sequences in polyvinylalcohol by viscometry.
8.Determination of molecular weight of a polymer by turbidimetry.
9. Preparation of Polymethylmethacrylate by suspension polymerization / polystyrene by free radical polymerization / Nylon by interfacial polymerization / Polyacrylamide by solution polymerisation method / polyvinylalcohol from polyvinylacetate / Phenol formaldehyde/ urea formaldehyde resins.

C. Computer related experiments

The following exercise may be given to illustrate the use of Softwares such as Excel and Origin in calculation and plotting curves using the data generated in regular lab experiments.

1. Use of mathematical functions to calculate parameters such as ionic strength, rate constants, dissociation constants, energy of activation, standard deviation, average molecular weights of polymer samples or any other similar calculation.

2. Use of software to make linear plots and calculate constants from slopes and intercepts-data from experiments such as verification of beer's law, determination of pKa of weak acids from pH data, determination of energy of activation , viscosity with concentration for determination of unknown concentration/ average molecular weight of polymers or any other similar data sets.

3. Use of software to fit multiple set of data obtained in different series of experiments on the same chart- pka of differen weak acids, kinetic data with different ionic strength conditions etc-or any other series of data may be given.

4. Use of software to fit non-linear curves with data from experiments such as absorbance vs. wavelength, first derivative curves of potentiometric and pH titrations, radioactive decay or any other similar experiments.

5. Programme writing and numerical analysis.
   Use of commercial software packages such as Mathcad, Matlab, Aspan Plus, Design II, Use of Chem draw and Chem sketch for construction of molecules. Use of Window excel for drawing graphs estimation of slope intercept.

REFERENCES:-

1. Willard, Merrit,Dean & Settle:Instrumental Methods of analysis(Van Nostrand.NY)1981.
2. Sawyer and Roberts : Experimental Electrochemistry for Chemists (Wiley , N.Y)1974.
3. B.P.Levitt : Findlay's Practical Physical Chemistry, (Longman, London), 1973.
4. J.B. Yadav :Advanced Physical Chemistry Experiments (Goel Publishing House), 1988.
5. F. J. Welcher(Ed): Standard methods of Chemical Analysis (Kriegen, N.Y)1975.
6. Computers and their applications to Chemistry, Ramesh Kumari, Narosa
7. Theory and Problems of Programming with Basic, Mc graw Hill, NY,1987.
8. Computer programming in Fortran IV,V , Rajaraman, Prentice Hall of India, 1987.
9.Computers in Chemistry & Instrumentation,Vol.1-5 Mattson, Marcel Dekker, NY,1974

AC P 559: PROJECT WORK AND DISSERTAION