

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

Ph. D. COURSE WORK IN CHEMISTRY

SELECTED TOPICS IN PRESENT DAY CHEMISTRY

UNIT -1: Transition Elements & Bio-Inorganic Chemistry

Transition Elements: Co-ordination chemistry of Transition elements, Stability constants of Transition metal complexes and interpretation of their electronic spectra, Charge Transfer spectra with reference to Tetrahedral and Octahedral complexes; Spectrochemical Series, Spin-Orbit Coupling & L-S Coupling or R-S Coupling, Redox reactions, Nephelauxetic or Cloud Expanding Effect; Trans-Effect. Complex formation titrations: Metal ion buffers and titrations involving unidentate ligands.

Bio-Inorganic chemistry: Photosynthesis: Light and Dark Reactions, Nitrogen Fixation and its Mechanism.

UNIT – 2: Chemical Kinetics & Electro Chemistry & Photochemistry

Chemical Kinetics: Fast reactions; Rate constants of fast reactions and their determination, Flash photolysis; Influence of solvent on the rate of reactions; Influence of frequency factor and ionic strength.

Electrochemistry: Electrokinetic phenomenon; Electro-Osmosis; Streaming potential; Electrophoresis; Zeta-potential. Fuel cells; Solar cells (photochemical, photovoltaic); Batteries (solid - state & conventional).

Photochemistry: Quantum yield, Principles of energy transfer, Photosensitization; Flash photolysis and its applications, Organic photochemistry, Photochemical cleavage of water.

UNIT-3: Biomaterials & Surface Chemistry

Biopolymers (Proteins, Enzymes, DNA, Carbohydrates); Self organizing systems (Micelles, Lipids, Cyclodextrins, Liquid crystals, Reverse micelles); Peptides and Proteins; Supramolecular Chemistry; Sensors; Biosensors; Preparation, Characterization and application of nanoparticles.

Surface Chemistry: Factors influencing adsorption; Negative and Positive adsorption; Chemisorptions

UNIT-4: Extractions, Oxidation and Reduction Equilibria

Liquid – Liquid Extractions and Separations: Distribution constant and Distribution ratios and applications of extractions.

Oxidation and Reduction Equilibria: Feasibility of Redox titrations, Redox indicators and its structural chemistry, Potentiometric methods of analysis, indicator Electrodes, potentiometry titrations.

Applications of acid-base titrations: Determination of nitrogen, sulphur, ammonium salts, nitrates, and nitrites carbonates and bicarbonates, and organic functional groups like carboxylic acid, sulphonic acid, amine, ester, hydroxyl, carboxyl groups, air pollutants like SO₂.

Acid-base titrations in non-aqueous solvents: Role of solvent in Acid-base titrations, solvent systems, differentiating ability of a solvent, some selected solvents, titrants and standards, titration curves, effect of water, determining the equivalence point, typical applications-determination of carboxylic acids, phenols and amines.

UNIT -5: Organic Chemistry

Optical Isomerism: Elements of symmetry and chirality - DL and RS notations – Absolute asymmetric synthesis; Asymmetric Induction; Stereospecific and Regiospecific synthesis.

Reactive Intermediates: Structure, stability, shape and Reactivity of carbonium ions and carbanions.

Retrosynthetic Analysis: Guidelines, C - C disconnections, FGI; Multistep synthesis, Chemoselectivity problems.

Reactions at unactivated C-H bonds: The Hoffmann Loeffler-Freytj reaction, Barton reaction, Photolysis, Reactions of organoboranes; Applications of Organo silicon compounds in synthesis Oxidation of hydrocarbons, Alcohols, carbon-carbon double bonds, oxidation with RuO₄ and Rhodium nitrate.

Reduction: Catalytic hydrogenation-Reduction with LiAlH₄, NaBH₄, trialkyl borohydrides

Unit 6: REVIEW OF RESEARCH WORK

Seminars on their relevant research specialization area

<http://www.sciencedirect.com/science/article/pii/S0040402009015348>

<http://www.sciencedirect.com/science/article/pii/S0304510294000727>

<http://www.sciencedirect.com/science/article/pii/S0010854511000518>

<http://www.sciencedirect.com/science/article/pii/S0016236112002062>

<http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/photchem.htm>

<http://www.sciencedirect.com/science/article/pii/S0378382011000634>

<http://cdn.intechweb.org/pdfs/13726.pdf>

<http://www.sciencedirect.com/science/article/pii/S138955671000002X>

<http://www.sciencedirect.com/science/article/pii/B9780124158009000012>

<http://www.sciencedirect.com/science/article/pii/S0003267098001263>

<http://www.pnas.org/content/101/44/15597.full.pdf>

<http://www.sciencedirect.com/science/article/pii/S1631074807001324>

<http://journal.sconline.org/pdf/cc2002/cc053n03/p00185-p00191.pdf>

<http://www.onlinepharmacytech.info/docs/vol2issue3/JPST10-02-03-03.pdf>

<http://www.sciencedirect.com/science/article/pii/0027510787903058>

<http://www.sciencedirect.com/science/article/pii/000927978790069X>

REFERENCES

1. "Advances in Inorganic Chemistry", F. A. Cotton and Wilkinson: 1989.
2. "Inorganic Chemistry", Atkins.
3. "Physical Chemistry", Samuel Glasstone and D. Lewis: Mc Millan India Ltd. New Delhi (2nd Edition, 1984).
4. "Physical Chemistry", Peter Atkins and J. D. Paula, ELBS, Low Price Edition (7th, Edition, 2002).
5. "Principles of Physical Chemistry", Maron and Prutton: Oxford and IBH Publishing Co Pvt Ltd (New Delhi) and Calcutta (4th Edition, 1966).
6. "Quantitative Analysis", Day & Underwood, Erinoice silver of India Pvt. Ltd.
7. "Fundamental of Analytical Chemistry", S. Koog & West.
8. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint.2003 Pearson Education Pvt. Ltd., New Delhi.
9. "Instrumental Methods of Analysis" Hobart H. Willard, D. U. Merritt and J. R. J. A. Dean: C. E. S. Publishers and Distributors.
10. "Text book of Quantitative Inorganic Analysis", A. I. Vogel.
11. "Principles of Biochemistry", A. L. Lehinger: Worth Publications.
12. "Nanomaterials", A. K. Bandyopadhyay: Newage International (p) Limited Publishers.
13. "Advanced Organic Chemistry", Jerry March, John Wiley & Sons, New York, London, 2001.
14. "Organic Chemistry", R. T. Morison and R. N. Boyd, Allyn & Bacon Inc., 2001.
15. "A Guide-book to Mechanism in Organic Chemistry", Peter Sykes Orient Longmans Ltd., New Delhi, 1976.
16. "Modern methods of Organic Synthesis" W. Carruthers.
17. "Retrosynthetic Analysis" Stuwart and Warren.