

Raja Mahendra Pratap Singh University, Aligarh

Pre-Ph.D. Course work

Chemistry

Unit-I:

(A) Organometallics

- Definition, Classification, nature of carbon-metal bond, methods of preparation, general properties, stability, cyclopentadienyl complexes, arene transition metal complexes, structures, catalytic properties and applications.

(B) Coordination Chemistry

- Macrocyclic Complexes: Types of macrocyclic ligands- design and synthesis by coordination template effect, di- and poly- nuclear macrocyclic complexes: macrocyclic polyamines and polyethers; applications of macrocyclic complexes.

Unit-II

(A) Supramolecular Chemistry

- Secondary bonds $M \cdots X$ ($M = S, Se, Te; X = N, O, P, S$) and weak noncovalent interactions $C-H \cdots X$ ($X = O, Cl, Br, I, S$).
- Self-Process- Programmed Supramolecular Systems: self-assembly of Double-Helical and Triple-Helical metal complexes.

(B) Advanced Bioinorganic & Bioorganic Chemistry

- Metalloprotein (Ferritin, transferrin, siderophores, rubredoxin, ferredoxin, high potential Fe-S)
- Metalloenzymes (Zinc, Molybdenum, Copper, Iron)
- Metals in medicine: Deficiency, disease, toxic effects, metals used for diagnosis and chemotherapy with particular reference to Pt, Ru, Au, Ag anticancer drugs
- Biosynthesis Pathways: Acetate-malonate pathway (Polyketide pathway), Mevalonic acid pathway (MVA), Shikimic acid pathway

Unit-III

(A) Modern Techniques in Chemical Sciences

- FTIR Spectroscopy, X-Ray Diffraction Studies, ^1H , ^{13}C , 2D NMR Spectroscopy
- Mass Spectrometry, UV-Vis Spectroscopy, Cyclic Voltametry
- SEM-EDX, TEM, XPS, TGA, DSC, DTA
- HPLC, GC-MS, Gel electrophoresis

(B) Coupling reaction involving Organometallic/Metallic Reagents

- Suzuki Reaction, Heck reaction, Kumada Coupling Reaction, Sonogashira reaction
- Newer Oxidative & Reductive reagent in Chemical research.

Unit-IV

(A) Chemical Kinetics

- Kinetics of ligand substitution reaction and its classification.
- Entropy and Volume of activation and its determination. Kinetic isotope effect, solvent isotope effect and Linear free energy relationship.

(B) Introduction to Nanomaterials

- Classification of Nanomaterial, Synthesis and processing: Mechanical grinding, Wet chemical synthesis, Sol-gel process, Gas phase synthesis, Sputtered plasma processing, Microwave plasma processing, Optical, Electrical, Magnetic, Mechanical properties of nanomaterials and its applications

- 1) Prof. Anite A. Pandey
- 2) Prof. Anjul Singh
- 3) Prof. Anshu Agrawal
- 4) Prof. Nileep Gupta
- 5) Prof. Neeraj Sharma

Anite
Anjul
Anshu
Nileep
Neeraj

Prof. Anjul Singh
Coordinator

RECOMMENDED BOOKS

1. Organometallic Chemistry of the Transition Metals – Robert H. Crabtree
2. Organometallic Chemistry – Gary O. Spessard & Gary L. Miessler
3. The Organometallic Chemistry of the Transition Metals – R.H. Crabtree (7th Ed.)
4. Basic Organometallic Chemistry – B.D. Gupta & A.J. Elias
5. Advanced Inorganic Chemistry – F.A. Cotton & G. Wilkinson
6. Inorganic Chemistry – Gary L. Miessler, Paul Fischer & Donald Tarr
7. Inorganic Chemistry – Shriver & Atkins
8. Principles of Bioinorganic Chemistry – Stephen J. Lippard & Jeremy Berg
9. Supramolecular Chemistry – Jonathan W. Steed & Jerry L. Atwood
10. Introduction to Supramolecular Chemistry – Günter Wipff
11. "Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life" – Wolfgang Kaim & Brigitte Schwederski
12. "Principles of Bioinorganic Chemistry" – Lippard & Berg
13. "Bioinorganic Chemistry" – Bertini, Gray, Lippard & Valentine
14. Spectrometric Identification of Organic Compounds" – Silverstein, Webster & Kiemle
15. Introduction to Spectroscopy" – Pavia, Lampman, Kriz
16. Physical Methods in Chemistry and Nano Science" – R. S. Drago
17. Instrumental Methods of Chemical Analysis- Gurdeep R. Chatwal & Sham K. Anand
18. Instrumental Analysis" – Douglas Skoog, Holler & Crouch
19. Analytical Chemistry" – Gary D. Christian
20. Chemical Kinetics" – Keith J. Laidler
21. Chemical Kinetics and Reaction Dynamics" – Paul L. Houston
22. Physical Chemistry" – Peter Atkins & Julio de Paula
23. Nanoscience and Nanotechnology" – K.K. Chattopadhyay & A.N. Banerjee
24. Nanotechnology: Principles and Practices" – Sulabha K. Kulkarni
25. Organic Chemistry (Vol I & Vol II) by I.L. Finar
26. Medicinal Natural Products: A Biosynthetic Approach by M. Dewick
27. Instrumental Methods of Analysis by Willard and Merritt
28. Spectroscopy by Chatwal & Anand
29. Nano: Essential Nanoscience and Nanotechnology by T. Pradeep