MPAT Syllabus 2019&2020

University of Rajasthan, Jaipur

Subject: CHEMISTRY Paper II

Inorganic Chemistry

1.Periodicity in elements.

2.Structure and bonding in homo and heteronuclear molecules, including shapes of molecules.

3.Concepts of acids and bases.

4.Chemistry of the main group elements and their compounds. Allotropy, synthesis bonding and structure.

5.Chemistry of transition elements and coordination compounds – bonding theories, spectral and magnetic properties, reaction mechanisms.

6.Inner transition elements – spectral and magnetic properties, analytical applications.

7.Organometallic compounds of transition metals – synthesis, bonding and structure and reactivity. Organometallics in homogeneous catalysis.

8.Cages and metal clusters.

9.Analytical Chemistry-principle, instrumentation and applications of separation techniques, Spectroscopic, electro- and thermoanalytical methods.

10.Bioinorganic Chemistry – photosystems, metalloporphyrins, metalloenzymes, oxygen transport, electron-transfer reactions, nitrogen fixation.

11.Concepts of Supramolecular Chemistry-chemistry of molecular recognition, Classification of Supramolecular Host Guest Compounds.Nature of Supramolecular interactions, cation and anion binding hosts, Applications of supramolecules.

12.Physical characterization of inorganic compounds by IR, Raman, NMR, EPR, Mossbauer, UV, NQR, MS, electron spectroscopy and microscopic techniques.

13.Nuclear chemistry – nuclear reactions, fission and fusion, radio – analytical techniques and activation analysis.

14.Application of Nano science and technology in Chemistry

15.Environmental Chemistry.

Organic Chemistry

1.IUPAC nomenclature of organic molecules including regio- and stereoisomers.

2.Principles of stereochemistry: configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity, asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction –substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution – optical and kinetic

3.Reactive intermediates and organic reaction mechanisms.

4.Concepts of aromaticity-benzenoid and non-benzenoid compounds – generation and reactions.

5.Pericyclic reactions – electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions.

6.Common named reactions and rearrangements and their applications in organic synthesis

7.Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations. Protecting group chemistry

8.Principles and applications of organic photochemistry. Free radical reactions.

9.Chemistry of natural products such as steroids, alkaloids, terpenes, peptides, carbohydrates, nucleic acids and lipids.

10.Chemistry of aromatic and aliphatic heterocyclic compounds.

11.Structure determination of organic compounds by IR, UV, NMR and Mass spectroscopic techniques.

12.Catalysis and green Chemistry.

13.Medicinal Chemistry.

Physical Chemistry

1.Basic principles and application of quantum mechanics – hydrogen atom, angular momentum.
2.Variational and perturbational methods.
3.Basics of atomic structure, electronic configuration, shapes of orbitals, hydrogen atom spectra.
4.Theoretical treatment of atomic structures and chemical bonding.
5.Chemical applications of group theory.
6.Basic principles and application of spectroscopy – rotational, vibrational, electronic, Raman, ESR, NMR.
7.Chemical thermodynamics.
8.Phase equilibria.
9.Statistical thermodynamics.
10.Chemical equilibria.
11.Electrochemistry – Nernst equation, electrode kinetics, electrical double layer, Debye Huckel theory. Voltammetry on nanostructured materials. Electrocatalysis. Corrosion and stability of metals.
12.Chemical Kinetics – empirical rate laws, Arrhenius equation, theories of reaction rates, determination of reaction mechanisms, experimental techniques.
13.Concept of catalysis.
14.Polymer chemistry. Molecular weights and their determinations. Kinetics of chain polymerization.
15.Solid – structural classification of binary and ternary compounds, diffraction techniques, bonding, thermal, electrical and magnetic properties.
16.Colloids and surface phenomena.
17.Data analysis, Precision and Accuracy.