SEMESTER -3 (Inorganic Chemistry)
Advanced Inorganic Chemistry
CHE(I) 501

Coordination Chemistry of Transition Metals:

UNIT 1

UNIT 2

Unit 3 – Chemistry of Non Transition Elements
Synthesis, Properties and structure of boranes, Carboranes, borazines, silicates, carbides, silicones, phosphazenes, sulphur nitrogen compounds, phosphorous cyclic compounds and noble gas compounds.
Iso and heteropoly acids

Unit 4- Solid state Chemistry
Molecular orbital theory of solids, electrical properties, insulators and semiconductors, super conductors, Schotty and Frenkel defects, Intermetallic, interstitial and non stoichiometric compounds, defects and non stoichiometry, electrical conductivity, Spinel structure, ferromagnetic antiferromagnetic, perovskite and related phases Chervrel phases, Atom and ion diffusion, mechanism of diffusion.

References:
1. Advanced Inorganic Chemistry, F. A. Cotton and Wilkinson, John Wiley,
SEMESTER -3 (Inorganic Chemistry)
Selected topics in Inorganic Chemistry
CHE(I) 502

Unit 1 – Ion Exchange

Unit 2 – Corrosion
Principles of corrosion and rate expressions, Different forms of corrosion – corrosion by sea water, corrosion of boilers, contact and crevice corrosion, stress corrosion cracking and related phenomena, hydrogen cracking corrosion prevention – corrosion inhibitors and passivators cathodic and anodic protection, metallic coating, role of paints and pigments, plastic linings, alloying for corrosion resistance.

Unit 3 - Electrochemical Methods
(a) Electrochemical methods: Polarography, principle, types of currents, polarographic potentials, instrumentation, pulse polarography, different pulse polarography, voltammetry: hydrodynamic, cyclic and anodic stripping voltammetry and applications.

Unit 4 - Thermal methods
(b) Thermal methods: Principles, instrumentation and application of TGA, DTA and DSC.

References:
3. J. Korkisch 1989 Handbook of ion exchange resins, their application to inorganic chemistry CRC Press, Boca Raton FL.
SEMESTER -3 (Inorganic Chemistry)
Inorganic Pharmaceutical & Medicinal Chemistry
CHE(I) 503

Unit 1.
(a) Pharmacopocia and Monography
Electrolytes, major physiological ions, physiological acid-base balance, acid base imbalance, electrolytes used for replacement therapy, electrolytes used in combination therapy.
(b) Gastro-intestinal tract agents – Acidifying agents, gastric antacids, protective and adsorbents, saline cathartics
Antioxidants and buffers

Unit 2
(a) Expectorants and Emetics- symptoms of respiratory disease, expectorants, antitussive and emetics.
(b) Topical agents – Protective, astringents and antimicrobials

Units 3
(a) Trace elements- copper, iron, iodine, manganese, zinc, their compounds and their relevance.
(b) Metals in medicine : Biomedical significance. Role of metal ions in drug design
Platinum antitumor agents- discovery and development, synthesis.

Unit 4
(a) Vanadium complexes –oxovanadium(IV) complexes for diabetes treatment
(b) Medicinal applications of metal complexes of N-Heterocyclic carbenes (NHC)-
NHC precursors and metal complexes –pyridine based NHC precursors and metal complexes, NHC Rhodium complexes.

References :
2. Medicinal Inorganic Chemistry, American Chemical Society, Washington, DC
SEMESTER -3 (Inorganic Chemistry)
Supramolecular Chemistry
CHE(I) 504

Supramolecular Chemistry
An examination of non-covalent interactions and their impact in chemistry. Topics will include self-assembly with special emphasis on supramolecules derived from calix systems, molecular recognition, and their applications for the design and synthesis of nanostructured materials.

I. Introduction to Supramolecular Chemistry and molecular forces responsible for supramolecular structures.

II. Molecular Structure: Shape and Size
   (i) Van der Waals radii
   (ii) Bond lengths and bond angles
   (iii) Conformation

III. Common Motifs in Supramolecular Chemistry with a brief overview of experimental techniques in supramolecular Chemistry.

IV. Host / Guest Chemistry
   (i) Cation binding
   (ii) Anion binding
   (iii) Neutral molecule binding

References:
1. Supramolecular Chemistry by Jonathan Steed & Jerry Atwood will be the primary textbook.
2. Supramolecular Chemistry: Concepts and Perspectives By Jean-Marie Lehn

SEMESTER -3 (Inorganic Chemistry)
CHE(I) 505 & 506 PR(PRACTICALS)

1. Analysis of alloys and ores
2. Capacity of ion exchangers
3. Separation of cations and anions using ion exchangers
4. Determination of trace elements by atomic spectroscopy.
5. Analysis of selected drugs
6. Determination of ionization constants and stability constants by potentiometry.
7. Preparation of metal complexes and characterization by IR
10. Thermal analysis and interpretation
11. XRD analysis of compounds.
12. Analysis of industrial effluent

References:
1. Vogel’s Text book of Quantitative chemical analysis
2. Vogel’s Text book of Qualitative analysis
3. The Quantitative Analysis of Drugs, D. C. Garratt
SEMESTER -4 (Inorganic Chemistry)
Advanced Inorganic Chemistry-CHE(I) 507

UNIT I
**Infrared Spectroscopy:**
Theory and Application of FT-IR. Symmetry and shape of $AB_2, AB_3, AB_4, AB_5$ and $AB_6$.
Modes of bonding of ambidentate ligands. Effect on coordination on ligand Bands, Change in symmetry on coordination. Organometallic compounds. Metal ligand vibration.

**Electron Spin Resonance.**

UNIT II
**Nuclear Magnetic Resonance Spectroscopy**

**Mossbauer Spectroscopy**
Basic principle, Spectral parameters and spectrum display. Interpretation of Isomer shift. Application of Technique to the studies of bonding and structure of $Fe^{2+}$ and $Fe^{3+}$ compounds, $Sn^{2+}$ and $Sn^{4+}$ compounds and detection of oxidation states. FAB and electonspray mass spectrometry of metal complexes.

UNIT III
**Organotransition Metal Chemistry**
Organometallic reagents in organic synthesis and in homogenous catalytic reaction (Hydrogentaion, hydroformyilation, isomerisation and polymerisation). $\pi$ bonded organometallic compounds including carbonyls, nitrosoyls, tertiary phosphines, hydrides, alkene, alkyn, cyclobutadiene, cyclopentadiene, arene compounds. Futuristic aspects of organotransition metal chemistry. Activation of small molecules by coordination.

UNIT IV
**Chemistry of Lanthanides and Actinides**
Separations, spectral and magnetic properties, organometallic chemistry of lanthanides and actinides.
Transuranium elements.

References
8. Organometallic Chemistry a Unified Approach by R.C.Mehrotra and A.Singh,
SEMESTER -4 (Inorganic Chemistry)
Selected topics in Inorganic Chemistry
CHE(I) 508

Unit 1 - Electrolytic process
Electrolytic processes: The Chlor-Alkali industry – General concepts and brine electrolysis chlorine cell technology, sodium potassium.

Unit 2 - Marine chemicals
Marine Chemicals: Chemical properties of marine waters, salinity, chlorinity and its significance, method of determination, Recovery of metals and non-metals from seawater, biochemical reactions, pollutants and impact.

Unit 3- X-ray diffraction Methods
Production of x-rays and Bragg’s equation, instrumentation and application for structural studies.

Unit 4- Surface characterization by spectroscopy
Surface characterization: Photoelectron spectroscopy – principle, instrumentation and applications.

References:
4. Elements of X-Ray Diffraction (3rd Edition), B.D Cullity,

SEMESTER -4 (Inorganic Chemistry)
Advanced Industrial Inorganic Chemistry
CHE(I) 509

Advanced Industrial Inorganic Chemistry
Unit 1 - Nanomaterials in Chemistry
Introduction to nanomaterials and nanochemistry, classification of nanomaterials general methods of preparation and applications. Chemical and catalytic aspects of nanocrystals – nanomaterials in catalysis, as adsorbents, as new chemical reagents.

Unit 2 – Smart materials

Unit 3 – Chemical and Biofertilizers
Chemical fertilizers, applications, adverse effects, Advantage of biofertilizers.
Types of Mineral Fertilizers: Nitrogenous fertilizers, phosphatic and potassic fertilizers, NPK grades.
Nitrogen biofertilizer: Rhizobium (symbiotic) Azetobactor (non symbiotic)
Phosphorus biofertilizer: P.S. B. phosphate solubilizing bacteria.
Unit 4 – Environmental Chemistry
Types of water pollutants: organic, inorganic, radionuclides and their determination COD, BOD and industrial waste water treatment for solids, metals, dissolved organics and inorganics.
Air pollutants –CO, SO\textsubscript{x}, NO\textsubscript{x}, CFC, hydrocarbon and their monitoring.
Disposal of hazardous wastes.

References:
1. Nanoparticles, buildings blocks of nanotechnology, Rotello V. Kluwer Acad / ptenum publication, N.Y.2004
5. Environmental Chemistry, Akde,Wiley Eastern Ltd.
7. Environmental Chemistry, B. K. Sharma, Goel Publishing House, Meerut

SEMESTER -4 (Inorganic Chemistry)
Intellectual Property rights basics
CHE(I) 510

Unit -1
General Introduction of IPRs
Indian Patent System in brief
Important Amendments of Indian Patents Act & Rules
What is IPR?
IP Protection
Importance of IP Protection
Why patent protection?
Why trade marks protection?
Why design protection?

Unit-2
Basic concept in patents
Patentable and non-patentable inventions
Patentability criteria and requirements
Practical study of novelty and non obviousness

Unit-3
Provisional, complete application and their contents and different types of patent applications (Basics)
Claim and their interpretation
Prosecution of patent application
Unit-4
Prior art Search-1
Prior art Search-2
Requirement of IPRs in Pharmaceutical & Chemical industries and career development in IPR

References:
1. Intellectual Property Rights, Anita Rao & Bhanoji
2. The Law Of Intellectual Property Rights, Shiv Sahai Singho
3. Intellectual Property Rights in the WTO and Developing Countries, Jayashree Watal

SEMESTER -4 (Inorganic Chemistry)
dissertation/industrial training
CHE(I) 511 & CHE(I) 512