## Course: Discipline Specific Core 11

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| Semester | **5** |
| Paper Number | **HCHCR5112T (60 MARKS) & HCHCR5112P (40 MARKS)** |
| Paper Title | **CORE COURSE 11: INORGANIC CHEMISTRY** |
| No. of Credits | **Theory-04, Practicals-02** |
| Theory/Composite | Composite |
| No. of periods assigned | Th: 4<br>Pr: 3 |
| Name of Faculty member(s) | Dr. Sanjib Ganguly<br>Dr. Rahul Sharma |
| Course description/objective | ***Theory:***<br>***1. To understand the basic bonding principles in coordination complexes.***<br>***2. To have basic idea of the spectra and magnetism in the complexes***<br>***3. To appreciate the general trends in the d-block and f-block metals/ metal ions.***<br>***Practical:***<br>***1. To understand the principles of gravimetry and develop skills in some simple gravimetric analysis.***<br>***2. To be able to run the spectrophotometer and spectrofluorimeter in order to perform simple experiments with coordination complexes***<br>***3. To synthesize a synthetic analog of porphyrin and metallo-porphyrin*** |
| Syllabus | Annexure Core Course: 11 |
| Texts | |
| Reading/Reference Lists | **Theory:**<br>1.Huheey, J. E.; Keiter, E.A. & Keiter, R.L. *Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed.,* Harper Collins 1993, Pearson,2006.<br>2. Cotton, F.A., Wilkinson, G., Murrillo, C. A., Bochmann, M., *Advanced Inorganic Chemistry 6th Ed. 1999.,* Wiley.<br>3. Atkin, P. *Shriver & Atkins' Inorganic Chemistry* 5th Ed. Oxford University Press (2010).<br>4. Sinha, S. P., Ed., Lanthanide and Actinide Research (Journal, Vol. 1, 1986).<br>5. Wulfsberg, G., Principles of Descriptive Inorganic Chemistry, Brooks/Cole: Monterey, CA, 1987.<br>**Practical:**<br>Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis* 6th Ed., Pearson, 2009. |
| Evaluation | **Theory: 60 marks**<br>CIA: 10<br>End-Sem: 50<br><br>**Practical: 40 marks**<br>*(Continuous Assessment)*<br>Internal Assessment Exams: 30<br>Viva (End Sem): 8<br>Attendance: 2 |
| Paper Structure for the End Sem **Theory Exam** (50 marks) | 6 (SIX) Questions (each of 10 marks) will be set and the students will have to answer any 5 (FIVE).<br>Each of the Questions (10 marks) will consist of 2 or 3 parts (of 2/ 3/ 4/ 5 ) |

# Annexure Core Course (CC): 11

# (Credits: Theory-04, Practicals-02)

**CC: 11 (Theory) 52 Lectures**

**Module 1: Coordination Chemistry-II (36 Lectures)**

VB description and its limitations. Elementary Crystal Field Theory: splitting of dn configurations in octahedral, square planar and tetrahedral fields, crystal field stabilization energy (CFSE) in weak and strong fields; pairing energy. Spectrochemical series. Jahn- Teller distortion. Octahedral site stabilization energy (OSSE). Metal-ligand bonding (MO concept, elementary idea), sigma- and pi-bonding in octahedral complexes (qualitative pictorial approach) and their effects on the oxidation states of transitional metals (examples). Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of $d^n$ ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment: super exchange and antiferromagnetic interactions (elementary idea with examples only); d-d transitions; L-S coupling; qualitative Orgel diagrams for 3d1 to 3d9 ions. Racah parameter. Selection rules for electronic spectral transitions; spectrochemical series of ligands; charge transfer spectra (elementary idea).

**Module 2: Chemistry of d- and f- block elements (16 Lectures)**

*Transition Elements:* General comparison of 3d, 4d and 5d elements in term of electronic configuration, oxidation states, redox properties, coordination chemistry.

*Lanthanoids and Actinoids:* General Comparison on Electronic configuration, oxidation states, colour, spectral and magnetic properties; lanthanide contraction, separation of lanthanides (ion-exchange method only).

**CC: 11 (Practical) 42 Lectures**

1. Gravimetric Estimation of Ni(II) using Dimethylglyoxime (DMG).
2. Gravimetric Estimation of copper as CuSCN
3. Measurement of 10Dq by spectrophotometric method.
4. Determination of $\lambda_{max}$ of $Cu(OAc)_2.H_2O$ and $[Fe(phen)_3]^{2+}$ complexes.
5. Synthesis of a mixture of Ruthenium complex and their separation by
   (i) TLC (ii) Column Chromatography.
6. (i) Measurement of the luminescent spectra of a ruthenium complex
   (ii) Calculation of quantum yield of the ruthenium complex.
7. Synthesis of meso-tetra(p-tolyl)porphyrin [TTP]
8. Synthesis of the the Zn(II) complex of TTP.