126200 – Advanced Inorganic Chemistry

The course is given by Professor Zeev Gross; Professor Mark Gandelman from the Chemistry faculty.

Syllabus
a. Structure and Bonding: brief overview of transition metal orbitals, electron counting, formal oxidation state, 18-e rule, geometries for transition metal complexes (Crystal Field Theory, MO description), σ- and π-bonding, metal-metal bonding.
b. Comprehensive survey of types of ligands for TM complexes, and their electronic and steric properties. Typical spectroscopic methods and techniques for the characterization of TM complexes.
c. Chemical processes on TM: ligand exchange, oxidative addition, reductive elimination, migratory insertion, nucleophilic attack on the ligand. Mechanisms and synthetic outcomes.
d. Selected representative applications of TM complexes in catalysis, with emphasis on the impact of modern chemistry on urgent global needs such as processes for clean energy: mechanistic and practical aspects.

Learning outcomes:
Upon successful completion of this course students should be able to understand fundamentals of inorganic and organometallic chemistry and the impact on catalytic processes. Namely, they should be able to (a) analyze metal complexes and their ligands, understand their steric and electronic parameters; (b) understand typical chemical processes associated with metal complexes including their mechanistic futures; (c) understand mechanisms and applications of important organic, inorganic, and bioinorganic transformations catalyzed by TM complexes.
Type of grade: numerical
Prerequisites: Student must have accomplished compulsory courses in Inorganic and Organic Chemistry prior to this course (BSc level).
6. reading material: (1) R. H. Crabtree “The Organometallic Chemistry of the Transition Metals”; (2) J. Hartwig “Organotransition Metal Chemistry: From Bonding to Catalysis”; (3) J. P. Collman, L. S. Hegedus, J. R. Norton, R. G. Finke “Principles and Applications of Organotransition Metal Chemistry”