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## 1. SUBJECT: SELECTED TOPICS IN INORGANIC CHEMISTRY

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Code: CS301

Credits (ECTS): 5

Form of teaching: 150; lectures 30, seminars 45, other 75 hours

Programme: **CHEMICAL SCIENCES**

Course coordinator: Prof. Iztok Turel, PhD

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## 2. OBJECTIVES OF THE COURSE AND INTENDED LEARNING OUTCOMES (COMPETENCES)

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Student acquires knowledge on selected chapters in inorganic chemistry, knows how plan strategies for syntheses and is able to interpret the relationships between the structure, properties and potential application of selected types of compounds; knows how to apply various experimental methods to resolve problems associated with selected types of compounds.

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## 3. CONTENTS (SYLLABUS OUTLINE)

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From the topics listed below the student selects (in agreement with the supervisor) those that are mostly related to his research work. The course coordinator, who is in charge of the course, and the leader of the study take care that the student's workload corresponds to 5 credits. If more persons are taking the study programme, the whole process is coordinated by course coordinator.

- *Preparation of compounds with practical use.* Systematic review of synthetic principles used for the preparation of compounds and methods for their characterization. In-depth review of selected, up-to-date examples of practical applications: metal complexes as model compounds, photosensitive ruthenium compounds used in Graetzel cells, fluorescence metal compounds and their application in analytics, gold compounds and nanotechnology. Review of some most successful metal catalyst also used in industrial processes (Noyori, Grubbs, Heck, etc.). Mechanisms of action.
- *Biologically active complexes.* Review of selected compounds with confirmed biological activity already in clinical use, or have entered clinical trials. Design and synthesis of novel biologically active coordination compounds. Design will be based on the knowledge derived from the approved drugs (with known mechanisms of action) or from modern principles about functioning of biological systems. Novel strategies and methods will be used in the process. Through these procedures the student will acquire the knowledge for independent work in the field of biologically active compounds.
- *Metal complexes with macromolecules.* Metal complexes with macromolecules have great potentials for application. In general, two approaches for the synthesis of macromolecular metal complexes are known: a) coordination of metal ions on bulk polymers and b) preparation of a metal complex with monomeric unit followed by polymerization and formation of a polymer with metal ion bonded to the polymeric chain. Synthesis of metal complexes with macromolecules, characterization and

structural properties of the macromolecular metal complexes, applications in biomedicine.

- *Organometallic compounds.* Planning of the syntheses of organometallic compounds, experimental techniques of the syntheses, characterization of the products. Dynamic NMR spectroscopy as a tool for the study of dynamic behaviour of molecules: background, determination of thermodynamic and kinetic parameters and mechanism of dynamic process. The use of dynamic NMR spectroscopy for studying the reaction mechanism catalyzed by organometallic catalysts.
- *Metals in the environment.* Distribution of metals and their compounds in the environment, essential and toxic metal compounds, geochemical and anthropogenic sources of metals, importance of metals for living beings. Reactions and circulation of metals in environment (solubility of metal compounds; ligands for metals in the environment; origin, reactions and stability of coordination compounds; precipitation, adsorption, chemisorption, ionic exchange, redox reaction and fractionation of metals in ecosystems). Pollution of the environment with metal compounds (toxicity, limit values, legislation). Connection of mentioned topics with actual environmental problems. Remediation of soil and water, stabilisation of wastes (evaluation of the state of contamination with metals, principles and suitable methods of rehabilitation).

**DATE:** January, 2014