

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

|                      |                        |
|----------------------|------------------------|
| <b>Predmet:</b>      | KOORDINACIJSKA KEMIJA  |
| <b>Course Title:</b> | COORDINATION CHEMISTRY |

| Študijski program in stopnja<br>Study Programme and Level | Študijska smer<br>Study Field | Letnik<br>Academic Year | Semester<br>Semester |
|---|-------------------------------|-------------------------|----------------------|
| MAG Kemija, 2. stopnja                                    | /                             | 1.                      | 1.                   |
| USP Chemistry, 2 <sup>nd</sup> Cycle                      | /                             | 1 <sup>st</sup>         | 1 <sup>st</sup>      |

**Vrsta predmeta / Course Type:**

izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:**

K2I01

| Predavanja<br>Lectures | Seminar<br>Seminar | Vaje<br>Tutorial | Klinične vaje<br>Work | Druge oblike študija | Samost. delo<br>Individual Work | ECTS |
|------------------------|--------------------|------------------|-----------------------|----------------------|---------------------------------|------|
| 30                     | 15                 | 30 LV            | /                     | /                    | 75                              | 5    |

**Nosilec predmeta / Lecturer:**

prof. dr. Franc Perdih / Dr. Franc Perdih, Full Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** slovenski / Slovenian

**Vaje / Tutorial:** slovenski / Slovenian

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Vsebina predmeta Koordinacijska kemija predstavlja nadaljevanje vsebine predmetov s področja anorganske kemije s prve bolonjske stopnje (Anorganska kemija) z bolj samostojno praktično uporabo sinteznih metod in osnovne karakterizacije, praviloma pri koordinacijskih spojinah. Natančna karakterizacija spojin temelji na povezavi podatkov iz strukturne analize in analize realnega vzorca s poudarkom na:

- Ugotavljanju čistosti in istovetnosti snovi z znano spojino.
- Ugotavljanju vrste kemijskih vezi in povezovanja v spojinah. Poudarek je na kovinskih ligandih  $M \cdots L$  (N,O,Cl) donor/akceptor splošni koordinacijski vezi in  $M \cdots C$  organokovinski vezi

**Content (Syllabus outline):**

A content of the Coordination Chemistry subject represents a continuation of the other inorganic chemistry field subjects from the first cycle study programs (Inorganic Chemistry) with more independent practical application of the synthetic methods along with the basic characterization, typically of the coordination compounds. A detailed characterization of compounds is based on structural and real samples analysis data correlation focussing on:

- Purity and identity determination of a material with the known compound.
- A type of the chemical bond analysis within the compound. Focus onto metal ligand  $M \cdots L$  (N,O,Cl) donor/acceptor general coordination bond and  $M \cdots C$  organometallic bond.

- opisu sfere ligandov okrog kovinskega iona z najpogostejšimi N, O, Cl in C donorskimi atomi.  
- Primerjavi strukturnih in analiznih podatkov s podatki kemijsko sorodnih spojin.

Splošne vsebine se predela na predavanjih in seminarjih, praktične na vajah v laboratoriju. Vsebina vaj: Sinteza koordinacijskih spojin na osnovi znanih literaturnih podatkov. Temu sledi natančna karakterizacija spojin s spektroskopskimi metodami, merjenjem magnetnih lastnosti ter prevodnosti. Vaje obsegajo uporabo metod IR in UV-Vis spektroskopije, magnetne susceptibilnosti ter električne prevodnosti. Metode karakterizacije ter primeri spojin so izbrani tako, da študentom omogočajo celovit in zaokrožen opis sintetiziranih spojin. Eksperimentalne vaje potekajo v skupinah z dvema do štirimi študenti ob mentorstvu učitelja ali asistenta.

- The coordination sphere of the metal ion description with the most common N, O, Cl in C donor atoms.  
- A comparison of structural and analytical data of the chemically related compounds

General contents will be accessed by lectures and seminars, practical work in the laboratory. Content of lab work: Synthesis of coordination compounds based on known literature data, followed by their detailed characterization with the spectroscopic, the magnetic susceptibility and the electrical conductivity methods. Practical methods include applying of IR and UV-Vis spectroscopy, magnetic susceptibility and electrical conductivity methods. Characterization methods and synthesized compound examples are selected to be completely and thoroughly described by the students. Experiments are conducted in groups of two to four students with the assistance of a teacher or an assistant.

#### Temeljna literatura in viri / Readings:

J. D. Lee, Concise Inorganic Chemistry, Chapman and Hall, 5. Izd. 1996, 7., 32. poglavje.  
M. Bochmann, Organometallics 1. Complexes with transition metal-carbon  $\sigma$ -bonds, Oxford University Press, 1994.  
M. Bochmann, Organometallics. 2, Complexes with transition metal-carbon  $\pi$ -bonds, Oxford University Press, 2009.  
Dopolnilna literatura /additional readings:  
A. K. Brisdon, Inorganic Spectroscopic Methods, Oxford Univ. Press, 1993.

#### Cilji in kompetence:

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*Cilji:* Načrtovanje projekta, ki obsega iskanje literature za sintezni postopek, sintezo spojine, njihovo analizo ter vrednotenje rezultatov s preverjanjem ujemanja rezultatov s podatki, navedenimi v objavljeni literaturi  
- Podrobnejša uporaba metod, primernih za karakterizacijo koordinacijskih spojin

*Kompetence:* Študenti bi začrtane naloge opravili z večjo mero samostojnosti, kar predstavlja realni prehod med opravljanjem in reševanjem preprostejših napisanih izzivov, s

#### Objectives and Competences:

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*Objectives:* Planning of the project comprising searching via literature for the synthesis procedure, the synthesis of compounds, their results analysis and evaluation by comparing them with the literature data.  
- A detailed methods application, suitable for the characterization of the coordination compounds

*Competences:* Students shall outlined tasks perform by the highest possible autonomy, revealing actual transition from the

katerimi se srečajo na osnovnem nivoju študija ter višjo samostojnostjo, ki se na ustreznem delovnem mestu pričakuje od osebe z izobrazbo druge bolonjske stopnje.

performance and solving of simple written challenges, facing on a basic study level and higher independence, which is at a specific working place expected for a person with a second cycle degree.

### **Predvideni študijski rezultati:**

#### Znanje in razumevanje

Študenti so sposobni samostojno načrtovati sintezno shemo spojine, jo potem izpeljati in sintetizirano koordinacijsko spojino natančno okarakterizirati. Imajo pregled nad dosegljivimi metodami in znajo oceniti njihovo uporabnost.

#### Uporaba

Načrtovanje izvedbe projekta je namenjeno predvsem reševanju zahtevnejših nalog, s katerimi se kemik pogosto sreča pri nadaljevanju študija ali pri delu. Potek od namena po izolaciji spojine in uporabe postopkov za njen opis proti morebitni oceni njene praktične uporabnosti je pogosto zahteven in dolgotrajen. Metode, ki jih študentje srečajo in uporabljajo pri tem predmetu, so lahko dostopne in omogočajo razne analize, od preprostih do bolj zapletenih.

#### Refleksija

Pridobljena znanja bodo študentu omogočila analizo izzivov pri reševanju nalog, s katerimi se bo srečeval v laboratoriju. Uporabil bo lahko primerno metodo, jo samostojno izpeljal ali vodil skupino ljudi pri določenem delovnem procesu.

#### Prenosljive spretnosti

Po končanem študiju bo izpeljava načrtane naloge na osnovi lastnega načrtovanja izvedbe tista bistvena sposobnost, ki se od strokovno usposobljene osebe pričakuje. Skupaj z znanjem, potrebnim za iskanje primernih virov informacij, nujnih pri izvedbi delovnih postopkov na določenem delovnem mestu, bo to morda največja prednost takšne osebe.

### **Intended Learning Outcomes:**

#### Knowledge and Comprehension

Students are independently able to design the coordination compounds synthesis scheme, perform that synthesis and accurately characterize the synthesized coordination compound. Show an overview of the accessible methods and know how to evaluate their applicability.

#### Application

A plan for a project execution is structured primarily to complex tasks solving, a chemist often meets at advanced studies or professional careers. The procedure from an intention for a compound isolation and its characterization towards assessment of its potential practical application is often difficult and time consuming. The methods students meet and apply in this course are easily accessible enabling various analyses, from routine to more specific.

#### Analysis

The acquired knowledge will enable students to analyse the challenges at addressed tasks, encountering in the laboratory. The appropriate method will be chosen, carried out independently or even as a group leader in a particular working process.

#### Skill-transference Ability

A practical application of an own planned task, will be the essential skill, one would expect from the professionally qualified person. Along with the knowledge needed to find appropriate information sources, being necessary at the work processes execution at the specific working place, this may be the most important advantage of such a person.

### **Metode poučevanja in učenja:**

### **Learning and Teaching Methods:**

|  |   |
|--|---|
| -predavanja,<br>-seminarji,<br>-praktične vaje v laboratoriju. | - lectures,<br>- seminars,<br>- practical exercises in the lab. |
|--|---|

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %) **Assessment:**

|  |  |   |
|--|--|---|
| Pisni izpit po uspešno opravljenem praktičnem delu.<br><br>Ocene: pozitivno 6-10 |  | Written exam after practical work successfully completed.<br><br>Positive grades 6-10 |
|--|--|---|

**Reference nosilca / Lecturer's references:**

1. D. Sanna, J. Palomba, G. Lubinu, P. Buglyó, S. Nagy, **F. Perdih**, E. Garribba: Role of ligands in the uptake and reduction of V(V) complexes in red blood cells. *J. Med. Chem.* **2019**, 62, 654–664.
2. T. Koleša Dobravc, K. Maejima, Y. Yoshikawa, A. Meden, H. Yasui, **F. Perdih**: Bis(picolinato) complexes of vanadium and zinc as potential antidiabetic agents: synthesis, structural elucidation and in vitro insulin-mimetic activity study. *New J. Chem.* **2018**, 42, 3619–3632.
3. T. Koleša Dobravc, E. Lodyga-Chruscinska, M. Symonowicz, D. Sanna, A. Meden, **F. Perdih**, E. Garribba: Synthesis and characterization of VIVO complexes of picolinate and pyrazine derivatives. Behavior in the solid state and aqueous solution and biotransformation in the presence of blood plasma proteins. *Inorg. Chem.* **2014**, 53, 7960–7976.