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| <b>Course title</b><br>Wykład monograficzny - Radiochemia środowiska i ochrona radiologiczna / Monigraphic lecture - Environmental radiochemistry and radiological protection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             | <b>ECTS code</b><br>13.3.0701                                                                                                                                                               |  |
| <b>Name of unit administrating study</b><br>Faculty of Chemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                                                                                                                                                                                             |  |
| <b>Studies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                                                                                                                                                                                             |  |
| <b>Field of study</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Type</b> | <b>Form</b>                                                                                                                                                                                 |  |
| Chemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Master      | Full-time studies                                                                                                                                                                           |  |
| <b>Teaching staff</b><br>Prof. dr hab. Bogdan Skwarzec                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |             |                                                                                                                                                                                             |  |
| <b>Forms of classes, the realization and number of hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             | <b>ECTS credits</b> 3                                                                                                                                                                       |  |
| <b>A. Forms of classes, in accordance with the UG Rector’s regulations</b><br>lecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             | classes - 30 h<br>tutorial classes – 5 h<br>student’s own work – 40 h                                                                                                                       |  |
| <b>B. The realization of activities</b><br>in-class learning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             | Total: 75 h - 3 ECTS                                                                                                                                                                        |  |
| <b>C. Number of hours</b><br>30 h lecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                                                                                                                                                                                             |  |
| <b>The academic cycle</b><br>Second year, winter semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                                                                                                                                                                                             |  |
| <b>Type of course</b><br>obligatory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | <b>Language of instruction</b><br>Polish                                                                                                                                                    |  |
| <b>Teaching methods</b><br><br>Lecture with multimedia presentation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | <b>Form and method of assessment and basic criteria for evaluation or examination requirements</b>                                                                                          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             | <b>A. Final evaluation, in accordance with the UG study regulations</b><br>course completion (with a grade)                                                                                 |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             | <b>B. Assessment methods</b><br>oral test                                                                                                                                                   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             | <b>C. The basic criteria for evaluation</b> or exam requirements<br>Obtaining a positive oral evaluation consisting of open questions covering only issues mentioned in the lecture issues. |  |
| <b>Required courses and introductory requirements</b><br>The student should have completed the specialization lecture at the first level studies: "Chemistry and radiochemistry of the environment", and "Laboratory of advanced chemistry" at the second-cycle studies<br>Students are required to pass obligatory subjects: completion of 1st degree chemical studies with the specialization of analyst and chemical diagnostics, food chemistry and cosmetics chemistry.<br>The monographic lecture is intended for students of 2nd degree chemistry specializing in analytics and chemical diagnostics as well as chemistry and environmental technology                                                                                                                                                                                                                                                                                                    |             |                                                                                                                                                                                             |  |
| <b>Aims of education</b><br>• acquaint students with all the issues mentioned in the lecture's program content,<br>• acquainting students with the nomenclature used in nuclear chemistry, radiochemistry and radiological protection<br>• familiarize students with the applications of radioactive elements in science, technology and medicine                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                                                                                                                                                                                             |  |
| <b>Course contents</b><br>Natural and artificial radioactivity. Spontaneous nuclear transformations. The theory of a-b-g synthesis of chemical elements. Influence of radioactivity on the development and evolution of life on Earth. Origin and occurrence of radioactive elements in nature. Radioactive activity and its units. Radiological heat of the Earth. Radiometric methods in radiochemical analysis. Interaction of ionizing radiation with matter. Radiation processes and radiolysis. Dosimetry, radiation doses and their units. The effect of small doses of ionizing radiation on humans. Radiological protection standards. Isotopic geochronology. The use of radioactive elements in science, technology and medicine. The origin of artificial radioactive elements in the environment. Disasters of nuclear power plants in Chernobyl and Fukushima and their effects on the environment. Radioactive waste and methods of its disposal. |             |                                                                                                                                                                                             |  |

## **Bibliography of literature**

### **A. Literature required to pass the course**

- B. Skwarzec, *Radiochemia środowiska i ochrona radiologiczna*, Wydawnictwo DJ s.c, Gdańska, 2002  
J. Sobkowski i M. Jelińska-Kaźmierczuk, *Chemia jądrowa*, Wydawnictwo Adamantan, Warszawa, 2006  
A. Czerwiński, *Chemia jądrowa i promieniotwórczość*, Oficyna Edukacyjna Krzysztof Pazdro, Warszawa 1998

### **B. Extracurricular readings**

- W. Szymański, *Chemia jądrowa*, PWN, Warszawa 1996

## **Knowledge**

1. defines the basic concepts related to the construction of the atomic nucleus, elementary particles and processes occurring in the nucleus,
2. knows and understands the types of nuclear transformations and has knowledge about radiometric methods used in radiochemistry,
3. understands the importance of radioactivity in the synthesis of chemical elements, and the development and evolution of life on Earth,
4. knows the influence of water radiolysis processes on health and human life,
5. has knowledge about the genetic and somatic effects of irradiation of the human body,
6. knows the views on the influence of low doses of radiation on humans,
7. knows the basic standards of radiological protection,
8. has knowledge about natural and artificial radioactive elements and their occurrence in nature,
9. knows the concept of radiation dose and differentiates its types and units,
10. has knowledge about the use of radionuclides in science, technology and medicine,
11. understands dilemmas related to the development of nuclear energy, 12. has knowledge about the effects on the environment of catastrophes at Chernobyl and Fukushima nuclear power plants and knows how to dispose of radioactive waste

## **Skills**

The method of verification of the assumed learning outcomes within a given subject:

The student correctly responds in writing or orally to questions including radiochemistry and radiological protection, knows the current directions of development and application of radioactivity in science, technology and medicine

The method of verifying the of social competences:

In the answers provided, the student understands the complexity of the problem he is describing, takes a distance approach to information provided by sources considered reliable

## **Social competence**

1. understands the need for further education in the field of radiochemistry and radiology,
2. dispels social concerns about the use of radioactive substances,
3. makes the society aware of the influence of radioactivity on human life,
4. presents methods of reducing the natural doses of radiation resulting from the presence of radionuclides in the air, food and building materials,
5. shows creativity in the use of radioactive isotopes in life and human development,
6. is cautious in dealing with radioactive substances