COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fundamentals of mineralurgy

Course

Field of study

Environmental Protection Technologies

Year/Semester

III/6

Area of study (specialization)

-

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

dr eng. Andrzej Szymański

e-mail: Andrzej.Szymanski@put.poznan.pl

Faculty of Chemical Technology

street: Berdychowo 4, 60-965 Poznań

phone: (61) 665 2806

Responsible for the course/lecturer:

Prerequisites

The student has the knowledge, skills and social competences resulting from passing previous semesters of the field of study Environmental Protection Technologies, in particular the subjects: General and Inorganic Chemistry (1st and 2nd sem.), Geochemistry (3rd sem.), Fundamentals of Chemical and Process Engineering (4 sem.), Chemical technology (5 sem.) and Fundamentals of electrochemical technology (5 sem.), among others:

Knowledge:

W1) Has extended knowledge of the structure of matter; identifies the components of matter and characterizes the interactions between them; knows that the physicochemical properties of elements (including reactivity) result of the electron configuration of their atoms and their position in the periodic table

W2) Knows the basics of geochemistry, especially issues related to rock formation processes

W3) Has general knowledge about basic unit operations and the possibilities of their use on both laboratory and industrial scale

W4) Knows the rules and principles of sustainable development in relation to industrial production in the chemical and related industries

Skills:

U1) Is able to use the periodic table of elements as the basic source of information about the physicochemical properties of elements and their compounds; predicts the direction of any type of chemical reactions, writes them and balances correctly

U2) Calculates correctly the energy effect of a chemical reaction based on the functions of the state of substrates and reaction products

U3) Can indicate examples of specific industrial applications of basic unit processes

Social competences:

K1) Is aware of the continuous, rapid expansion of knowledge in the field of inorganic chemistry, geochemistry and technological solutions in the chemical and related industries, and against this background - the level of his knowledge in this field, which causes his determination and active attitude in further study and assimilation new knowledge on his own initiative

K2) Is aware that knowledge on chemical subjects (including inorganic chemistry) is widely used in the chemical and related industries; understands in this connection and reckons with the necessity of practical use of acquired knowledge and skills in the future; is aware of the responsibility associated with this

K3) Understands the need and has a habit of continuous learning and raising their knowledge and qualifications

Course objective

Acquiring by the students the knowledge about mineral natural raw materials used in technologies of metallic element production, methods of their initial preparation for further processing as well as about the properties and applications of final products obtained. Particular emphasis will be placed on

engineering, technological and environmental aspects of the use of mechanical and physical methods for the separation and enrichment of ores and minerals of metallic elements on an industrial scale. To familiarize students with the negative effects of the mineral industry of metallic elements on the environment and how to mitigate the negative effects of this impact

Course-related learning outcomes

Knowledge

1. The student knows the types and the genesis (geological and geochemical conditions) of the formation of metallic element deposits and has general knowledge about their distribution on a global scale (K_W06, K_W07)

2. Has knowledge of the properties and applications of metallic elements and on technologies used for their production on an industrial scale using natural mineral resources (K_W06, K_W07)

3. Knows the unit operations used in the processing of mineral resources (in the mineral industry) and the general principles of their selection (K_W10)

4. Knows the development trends of the mineral industry of metallic elements and connected with them problems of raw materials (K_W11)

5. Has knowledge of the impact of the mineral industry on the environment and knows how to protect the environment against the negative effects of this impact (K_W14)

Skills

1. Is able to assess in terms of the technological usefulness the unit operations used in the processing of metallic element minerals (K_U16, K_U18)

2. Is able to select separation and enrichment processes (especially mechanical and physical) for a particular type of raw materials of metallic elements and a specific technological system (K_U16, K_U18)

3. Is able to indicate the main factors of harmful effects on the environment, related to the specific type of mineral being processed and the processing technologies selected for this purpose (K_U15, K_U16)

Social competences

1. The Student is able to disseminate and popularize the latest technological solutions in the mineral industry of metallic elements (K_K07)

2. Is aware of the need to enrich mineral resources as part of pro-ecological activities that support sustainable development (K_K02, K_K04, K_K05)

3. Understands the need for an appropriate approach to the processing operations of a particular mineral, which taking into account not only engineering, technological and economic aspects of the project, but also socio-environmental (K_K02, K_K04)

4. Is aware of the impact of engineering activities carried out under the processing of mineral resources obtained from the earth's crust (including mining operations) on the quality of the environment (K_K02)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The form of the final verification of learning outcomes/obtaining a grade in the subject, is chosen by students during the first class in the semester. The two options to choose from are: independent preparation of an extensive paper on a topic given by the teacher (a different topic for each student) or a final test, consisting of 20-40 closed and open (problem) questions of varying difficulty (variously scored) - threshold for passing: 50% of the total number of points. The final grade for the subject will be the grade for the prepared paper, or the grade for the final test, issued on the basis of the number of points obtained. The grades are issued using the grading scale in force at the Poznań University of Technology. Depending on the form of conducting the classes, the test will be carried out remotely or stationary.

Programme content

Lecture:

1. The Earth's crust as a global "warehouse" of mineral raw materials. The content of chemical elements in the Earth's crust. Compact and dispersed resources of mineral raw materials. Management of mineral raw material resources. Geological determinants of exploitation and processing of mineral raw material resources

2. Comminution of mineral raw materials. Properties of materials which determining their susceptibility to comminution. Comminution devices - selection criteria. Comminution in jaw, cone, cylindrical and rotor crushers - discussion of engineering and technological problems

3. Grinding of mineral raw materials. Ball, ring, rod and autogenous mills

4. Classification and sieving. Design and technological aspects of sieving process effectiveness. Sieving and grinding systems

5. Flow classification. Coexistence of classification and compaction. Mineral raw material enrichment during flow classification. Flow classification equipment (horizontal and vertical current gravity classifiers, centrifugal classifiers)

6. Air classification. Coupled technological systems consisting of a mill and an air classifier (cyclone)

7. Processes for concentrate enrichment. Enrichment of mineral raw materials with heavy liquid. Technological solutions for the circulation and regeneration of heavy liquid. Enrichment in jiggers, on concentration tables and in coil separators. Magnetic and electrical enrichment (magnetic and electrical properties of minerals). Electrostatic and dielectric separation. Separator constructions. Factors affecting separation efficiency

8. Characteristics of flotation processes. Selective and collective flotation. Flotation machines. Chemical and biological methods of concentrate enrichment

9. Sustainable exploitation of mineral raw materials from the Earth's crust. Environmental protection issues in mineralurgy. Characteristics of harmful environmental effects of mineral processing. Comprehensive use of mineral raw materials (ores). Waste management in mineral industry. Revitalization of areas after ores mining

10. Modern trends in mineralurgy. Leaching of useful ingredients directly from the deposit (in-situ leaching). Modern technologies for obtaining and processing of mineral raw materials for nuclear energetics (uranium and thorium ores). Nuclear Fuel Technology

Teaching methods

The lecture based on multimedia presentations containing relevant examples; as a supplement, additional examples with explanations, resulting from the current interest of students during the discussion at the lecture.

Bibliography

Basic

1. A. Polański, Geochemia i surowce mineralne. Wyd. Geol. Warszawa 1988

2. J. Drzymała, Podstawy mineralurgii, Oficyna Wydawnicza Politechniki Wrocławskiej 2001

3. J. Malewski J.: Przeróbka kopalin, Wydawnictwo Politechniki Wrocławskiej, Wrocław 1981

4. J. Blaschke, Procesy technologiczne w przeróbce kopalin użytecznych, Wydaw. Akademii Górniczo-Hutniczej im. S.Staszica, Kraków 1987

5. B. Jeżowska-Trzebiatowska, S. Kopacz, T. Mikulski, Pierwiastki rzadkie. Część 1, Występowanie i technologia, PWN, Warszawa-Wrocław 1976

6. Z. Celiński, Energetyka jądrowa, PWN, Warszawa 1991

7. M. Saternus, A. Fornalczyk, J. Dankmeyer-Łączny, Chemia ogólna dla metalurgów, Wydawnictwo Politechniki Śląskiej, Gliwice 2011

8. J. Barcik, M. Kupka, A. Wala, Technologia metali. Metalurgia ekstrakcyjna, Wydawnictwo Uniwersytetu Śląskiego, Katowice 1998

9. W. Charewicz, Pierwiastki ziem rzadkich. Surowce, technologie, zastosowanie, WNT, W-wa 1990

Additional

1. A. Bolewski, Miedź-Cu. Surowce mineralne świata. Wyd. Geol. Warszawa 1977

2. J. Marciniak-Kowalska, E. Konopka, Wzbogacanie chemiczne kopalin, skrypt AGH, Kraków 1982

3. J. Szymanowski, Ekstrakcja miedzi hydroksyoksymami, PWN, Warszawa-Poznań 1990

4. F. Łętowski, Podstawy Hydrometalurgii, WNT, Warszawa 1975

5. A. Bielański, Chemia nieorganiczna, PWN, Warszawa 2010

6. S. Siekierski, Chemia pierwiastków, SNS, Warszawa 1998

7. W. Trzebiatowski, Chemia nieorganiczna, PWN, Warszawa 1988

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	40	1,6
Student's own work (literature studies as part of preparation for current lectures, preparation for the final colloquium or writing a paper on a given topic) [1]	35	1,4

[1] delete or add other activities as appropriate