FACULTY OF CHEMISTRY

**SUBJECT CARD**

Name of subject in Polish: Materiały wykorzystywane w procesach i operacjach chemicznych
Name of subject in English: Materials used in chemical unit operation
Main field of study (if applicable Chemical and Process Engineering
Specialization (if applicable):
Profile: academic
Level and form of studies: 2nd level, , full-time
Kind of subject: optional
Subject code ICC020009
Group of courses: NO

| | Lecture | Classes | Laboratory | Project | Seminar |
|---|---|---|---|---|---|
| Number of hours of organized classes in University (ZZU) | 30 | | | | |
| Number of hours of total student workload (CNPS) | 60 | | | | |
| Form of crediting | crediting with grade | | | | |
| For group of courses mark final course with (X) | | | | | |
| Number of ECTS points | 2 | | | | |
| including number of ECTS points for practical (P) classes | | | | | |
| including number of ECTS points for direct teacher-student contact (BK) classes | 1 | | | | |

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. Basic knowledge on chem technology
2. Knowledge on material science

**SUBJECT OBJECTIVES**

C1 Introduction to material science with special emphasis to modern technology
C2 Presentation of place for materials in unit operation processes

**SUBJECT LEARNING OUTCOMES**

**Relating to knowledge:**

PEU_W01 – students know materials used in industry
PEU_W02 – students are able to assess usability of materials in a particular technology

**Relating to skills:**

PEU_U01 – students can shape and solve the problems

**Relating to social competences:**

PEU_K01 students understand a need to transfer their knowledge on engineering achievements to communities

**PROGRAM CONTENT**

| | **Lectures** | **Number of hours** |
|---|---|---|
| Lec 1 | Unit processes in chemical technology, materials used in chemical technology, classification | 2 |
| Lec 2 | Plastics, kind of polymers, crosslinking, polymer is solution, in gel and in solid state, polymer crystallinity | 2 |
| Lec 3 | Phase transition, glass temperature, polymer blends and composites, stability | 2 |
| Lec 4 | Separation, polymer membranes, preparation of membranes, modification of membranes | 2 |
| Lec 5 | Polymer sorbents, specialty sorbents, monodispersive sorbents, porous | 2 |

| | | |
|---|---|---|
| | structure, sorbent swelling, sorbents for hybrid processes | |
| Lec 6 | Ion exchange and chelating resins, SIR, core-shell resins | 2 |
| Lec 7 | Molecularly imprinted polymers, surface and bulk imprinting, natural sorbents | 2 |
| Lec 8 | Constructive polymers, chemical and mechanical resistivity, tests | 2 |
| Lec 9 | Carbon materials, activated carbon, porosity, sorption properties, sorbents and catalyst carriers | 2 |
| Lec 10 | Polymer carbon composites for such separation processes as ED, RO, NF, CDI or EDI | 2 |
| Lec 11 | Materials not prone for fouling, surface hydrophilization, super-hydrophilic and super-hydrophobic surfaces, polyelectrolytes, L-b-L structures | 2 |
| Lec 12 | Surface modification by layer deposition, plasma modification, surface grafting, ATRP method in surface alteration | 2 |
| Lec 13 | Inorganic materials, nanospheres, zeolites and perovskites, molecular sieves, sorbents and carriers, surface modification | 2 |
| Lec 14 | Metals, protective and passive layers, electrochemical protection, surface pree-treatment | 2 |
| Lec 12 | Summary | 30 |

**TEACHING TOOLS USED**

N1. Lecture with PPT presentations

**EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT**

| **Evaluation** (F – forming (during semester), P – concluding (at semester end) | Learning outcomes number | Way of evaluating learning outcomes achievement |
|---|---|---|
| F1 | PEU-W01, W02<br>PEU-U01<br>PEU-K01 | examination |

C=F1

**PRIMARY AND SECONDARY LITERATURE**

**PRIMARY LITERATURE:**

[1] [1] F.W.Billmeyer, Textbook of polymer science, J.Wiley New York, 1984
[2] J.F.Rabek, Współczesna wiedza o polimerach, PWN Warszawa, 2013
[3] S.Penczek, Z.Florianczyk, Chemia polimerow Tom I-III, Warszawa, 1995-98
[4] K.Li, Ceramic Membranes for Separation and Reaction, J.Wiley, 2007
[5] N.Hilal, Membrane modification, CRC Press 2012

**SECONDARY LITERATURE:**

[1] [1] E.Hoek, Encyclopedia of Membrane Science and Technology, J.Wiley, 2013
[2] A.Basile, Membrane for Membrane reactors, Elsevier, 2013

**SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)**

(Prof. Dr. Marek Bryjak, marek.bryjak@pwr.edu.pl