SYLLABUS

Name: ***Biomedical polymers and biomaterials (WTCAXCSM-BPaB)***
Name in Polish: **Polimery biomedyczne i biomateriały**
Name in English: ***Biomedical polymers and biomaterials***

Information on course:

Course offered by department: Faculty of Advanced Technologies and Chemistry
Course for department: Faculty of Advanced Technologies and Chemistry
Term: Summer semester 2026/2027 Year
Cordinator of course edition: dr hab. inż. Magdalena Urbańska

Default type of course examination report:

Graded pass

Language:

English

Course homepage:

https://www.wtc.wat.edu.pl/

Short description:

Definition of biomaterials, classification, role of chemical composition, working environment, properties, and applications of these materials. Metal, ceramic, polymer, carbon, and composite biomaterials. Modern polymer and hybrid systems used in biomedicine for diagnostic and therapeutic purposes.

Description:

Lectures
1. Definition of biomaterials, classification, role of chemical composition, working environment, properties, and applications of biomaterials. (2 hrs.)
2. Metal biomaterials (2 hrs.):
a) classification, chemical composition, mechanical and physical properties, applications,
b) austenitic steels,
c) cobalt-based alloys,
d) titanium and its alloys,
e) shape memory alloys.
3. Ceramic biomaterials (2 hrs.):
a) classification, chemical composition, mechanical and physical properties, applications,
b) resorbable in the body,
c) with controlled surface reactivity (bioglass),
d) neutral (alumina, zirconium oxide).
4. Polymer biomaterials (6 hrs.):
a) classification, properties, and applications,
b) natural (proteins, polysaccharides),
c) synthetic (biostable and biodegradable).
5. Carbon and composite biomaterials (2 hrs.)
Modern polymer and hybrid systems used in biomedicine for diagnostic purposes (e.g., contrast agents for magnetic resonance imaging) and therapeutic purposes (e.g., drug carriers) will also be discussed. (2 hrs.)
Exercises
1. Calculations concerning the strength of materials. (2 hrs.)
2. Calculations concerning the corrosion rate of materials. (2 hrs.)
Seminars
Development of specific issues related to biomedical polymers and biomaterials, and their presentation in the form of oral presentations. (10 hrs.)

Bibliography:

1. Biomaterials and bionanotechnology / Edited by Rakesh K. Tekade. London: Academic Press, an imprint of Elsevier, 2019.
2. Biomaterials in clinical practice: advances in clinical research and medical devices / Fatima Zivic, Saverio Affatato, Miroslav Trajanovic, Matthias Schnabelrauch, Nenad Grujovic, Kwang Leong Choy, editors. Cham: Springer International Publishing AG, © 2018.
3. Biomaterials from nature for advanced devices and therapies / edited by Nuno M. Neves, Rui L. Reis. Hoboken: John Wiley & Sons, cop. 2016.
4. Polymers for biomedicine: synthesis, characterization, and applications / edited by Carmen Scholz. Hoboken, New Jersey: John Wiley & Sons, 2017.
5. Biomaterials science and tissue engineering: principles and methods / Bikramjit Basu. First published in 2017.

Learning outcomes:

Symbol and number of the subject effect/learning effect/reference to the field effect
W1 / The student has established and extended knowledge in the scope of the chosen specialization / K_W01
W2 / The student has extensive knowledge of modern organic compounds with functional properties, finding applications in electronics, photonics, and materials engineering, among others / K_W08
W3 / The student knows current developments and the latest discoveries in chemical and related sciences / K_W11
W4 / The student knows the legal and ethical conditions related to research and teaching / K_W12
U1 / The student can locate necessary information in the professional literature, databases, and other sources, is familiar with basic scientific journals in the field of chemistry, and can assess the reliability of acquired information / K_U05
U2 / The student possesses in-depth skills in preparing written and oral presentations on topics related to general chemistry, drawing on Polish and foreign language publications, as well as their own observations and reflections / K_U08
U3 / The student can present the results of discoveries made in the field of chemistry and related disciplines in an accessible way and lead a discussion on these topics / K_U11
U4 / Can use a foreign language at level B2+ of the Common European Framework of Reference for Languages, to a degree that allows for oral and written communication on a general level and, to a higher degree, in the field of specialist terminology / K_U12
K1 / The student recognizes the importance of knowledge in solving cognitive and practical problems and in seeking expert advice when facing difficulties in solving a problem independently. Can critically evaluate the content they receive / K_K01

Assessment methods and assessment criteria:

The exercises are passed based on class attendance and activity during solving tasks.
The seminars are passed based on the following: presentations prepared independently.
Grades for lectures are given based on a written test.
The achievement of the W1, W2, W3, W4, U2, and K1 effects is verified through lectures, written tests, and exercises during task-solving.
Achievement of the U1, U3, and U4 effects is verified during the seminar and oral presentations.

Mode of study

full-time studies

Form of study

second-cycle studies

Course

elective

Introductory subjects

Chemical materials science. Prerequisites: Metallic materials, polymeric materials, ceramic materials, and composites.

Programs

Field of study: CHEMISTRY AND ANALYSIS OF HAZARDOUS MATERIALS

Form of course / number of hours / final requirement

lectures - 16 hours/grade passing
exercises - 4 hours/passing
seminars - 10 hours/passing

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ECTS balance

Activity/ hours
1. Participation in lectures / 16
2. Self-study of lectures / 10
3. Participation in exercises / 4
4. Self-preparation for exercises / 10
5. Participation in seminars / 10
6. Self-preparation for seminars / 15
Hours/ECTS
Total student workload: 65 / 2,5
Classes with teachers: 30 / 1,2
Classes related to scientific work: 65 / 2,5

Information on course edition:

Default type of course examination report:

Graded pass

Bibliography:

missing bibliography in English