



Module name: Recent achievements of biomaterials science

Academic year: 2019/2020 Code: ZSDA-3-0209-s ECTS credits: 3

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: prof. dr hab. inż. Pamuła Elżbieta (epamula@agh.edu.pl)

Module summary

PhD student learns about the principles of biomaterials science including biological phenomena at the interface, host response, biofilm formation as well as issues related to recent achievements in biomaterials for musculoskeletal system, delivery of drugs, genes and biologically active molecules, tissue engineering, regenerative medicine, wound dressings as well as imaging and diagnostic systems.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	PhD student can work in a team and discuss the impact of advanced biomaterials on healthcare in a clear and comprehensive way	SDA3A_K01	Activity during classes
Skills: he can			
M_U001	PhD student can propose methods to synthesise and characterize different types of biomaterials and medical devices	SDA3A_U01	Presentation
Knowledge: he knows and understands			
M_W001	PhD student knows recent advances of biomaterials and medical devices	SDA3A_W02	Activity during classes
M_W002	PhD student understands basic biomolecular mechanisms responsible for biocompatibility	SDA3A_W01	Activity during classes

Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
20	10	0	0	0	0	10	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	PhD student can work in a team and discuss the impact of advanced biomaterials on healthcare in a clear and comprehensive way	-	-	-	-	-	+	-	-	-	-	-
Skills: he can												
M_U001	PhD student can propose methods to synthesise and characterize different types of biomaterials and medical devices	-	-	-	-	-	+	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	PhD student knows recent advances of biomaterials and medical devices	+	-	-	-	-	-	-	-	-	-	-
M_W002	PhD student understands basic biomolecular mechanisms responsible for biocompatibility	+	-	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	20 h
Preparation for classes	10 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	20 h
Summary student workload	50 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

- 1.Introduction to biomaterials science: biomaterials, biocompatibility, medical devices
- 2.Biomaterial-biological milieu interaction: adsorbed water, proteins and biological molecules
- 3.Host reaction to biomaterials: blood coagulation and blood-material interaction, nonthrombogenic materials and strategies
- 4.Host reaction to biomaterials: inflammation, wound healing and foreign body reaction
- 5.Biofilms and biomaterials related infections, antimicrobial strategies
- 6.Biomaterials in musculoskeletal system
- 7.Biomaterials for delivery of drugs, genes and biologically active molecules
- 8.Biomaterials for tissue engineering and regenerative medicine
- 9.Biomaterials for wound dressings and skin substitutes
10. Biomaterials for imaging and diagnostic systems

Seminar classes

Multimedia presentations delivered by the PhD students based on recent publications from reputed journals in the field of Biomaterials Science. Group discussions.

Teaching methods and techniques:

Lectures: Treści prezentowane na wykładzie są przekazywane w formie prezentacji multimedialnej w połączeniu z klasycznym wykładem tablicowym wzbogaconymi o pokazy odnoszące się do prezentowanych zagadnień.

Seminar classes: Na zajęciach seminaryjnych podstawą jest prezentacja multimedialna oraz ustna prowadzona przez studentów. Kolejnym ważnym elementem kształcenia są odpowiedzi na powstałe pytania, a także dyskusja studentów nad prezentowanymi treściami.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

Positive grade from multimedia presentation at seminar classes, active participation in discussion during seminar classes

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:

- Attendance is mandatory: Yes
- Participation rules in classes: Studenci uczestniczą w zajęciach poznając kolejne treści nauczania zgodnie z sylabusem przedmiotu. Studenci winni na bieżąco zadawać pytania i wyjaśniać wątpliwości. Rejestracja audiowizualna wykładu wymaga zgody prowadzącego.

Seminar classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Studenci prezentują na forum grupy temat wskazany przez prowadzącego oraz uczestniczą w dyskusji nad tym tematem. Ocenie podlega zarówno wartość merytoryczna prezentacji, jak i tzw. kompetencje miękkie.

Method of calculating the final grade

80% - grade for multimedia presentation delivered at the seminar

20% - grade for participation in the discussion during seminars

Further details will be provided during the first meeting in the beginning of the semester.

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

In case of a justified absence on seminars the PhD student should immediately contact the teacher who will individually determine the options to catch up on seminars.

Prerequisites and additional requirements

Basic knowledge in chemistry, physics, materials science and biology

Recommended literature and teaching resources

1. Biomaterials Science: An Introduction to Materials in Medicine, Buddy D. Ratner, Alan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, 2013, Elsevier - Academic Press, 3rd edition; ISBN: 0125824637 and ISBN: 978-0-12-374626-9)

2. D. Williams, Essential Biomaterials Science, 2014, Cambridge University Press; ISBN 10: 0521899087 ISBN 13: 9780521899086

3. Biomateriały Tom 4, Monografia pod red. S. Błażewicza i J. Marciniaka, 2016, Polska Akademia Nauk, Akademicka Oficyna Wydawnicza EXIT, ISBN 978-83-7837-054-3

4. Recent publications provided by the teacher

Scientific publications of module course instructors related to the topic of the module

1. Wojak-Ćwik, I.M., Rumian, Ł., Krok-Borkowicz, M., [et al.], Scharnweber, D., Pamuła, E. Synergistic effect of bimodal pore distribution and artificial extracellular matrices in polymeric scaffolds on osteogenic differentiation of human mesenchymal stem cells Materials Science and Engineering C 97, 2019, 12-22.

2. Małgorzata Krok-Borkowicz, Elena Filova, Jaroslav Chlupac, Jan Klepetar, Lucie Bacakova, Elżbieta Pamuła, Influence of pore size and hydroxyapatite deposition in poly(l-lactide-co-glycolide) scaffolds on osteoblast-like cells cultured in static and dynamic conditions, Materials Letters 241, 2019, 1-5.

3. Ł. Rumian, H. Tiainen, U. Cibor, M. Krok-Borkowicz, M. Brzychczy-Włoch, H. J. Haugen, E. Pamuła, Ceramic scaffolds with immobilized vancomycin-loaded poly(lactide-co-glycolide) microparticles for bone defects treatment, Materials Letters 190, 2017, 67-70.

4. T. E. L. Douglas, G. Krawczyk, E. Pamula, [et al.], Generation of composites for bone tissue engineering applications consisting of gellan gum hydrogels mineralized with calcium and magnesium phosphate phases by enzymatic means, Journal of Tissue Engineering and Regenerative Medicine 10(11), 2016, 938-954.

Additional information

None