POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	1
Item Name	**RESEARCH METHODOLOGY AND PLANNING**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Anna Wenda-Piesik

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
I	**15[E]**	prof. dr. hab. inż. Anna Wenda-Piesik

[E] - egzamin

Disciplines of natural sciences and engineering and technology
prof. dr. hab. inż. Anna Wenda-Piesik

Lecture 1. The scientific paradigm and its importance in the development of civilization.
Lecture 2. Definitions and structure of science. Science as creativity, heuristics.
Lecture 3. Types of human knowledge. Features of scientific knowledge.
Lecture 4. Deduction and deductive sciences. Stages of development of deductive systems.
Lecture 5. Deductive inferences in the development of logic.
Lecture 6. Empiricism and Inductive Methods.
Lecture 7. Mill's canons.
Lecture 8. Reasoning and justifications in science.
Lecture 9. Principles of investigating scientific problems.
Lecture 10. Methods of analysis and synthesis in applied research.
Lecture 11. Coincidence, imagination, talent and intuition in science.
Lecture 12. Conceptualism and concepts of research processes.
Lecture 13. Classification of sciences according to subject and methodological criteria.
Lecture 14. Classification and degrees of scientific classifications.
Lecture 15. Recognition, the power of the scientist's influence.

II	**30[E]***	prof. dr. hab. inż. Anna Wenda-Piesik dr hab. inż. Adam Lipski, prof. PBŚ

[E] - egzamin
*- subject taught separately in a group of disciplines

Disciplines of natural sciences
prof. dr. hab. inż. Anna Wenda-Piesik

Lecture 1. History and development of experimental methods in the natural sciences in the world.
Lecture 2. Introduction to experimental methods (Experiment and science, paradoxes of deformation and artificiality of experiments).
Lecture 3. Formulating and justifying the topics of scientific papers, setting the goals of research work, formulating hypotheses, the role of hypotheses, reasoning.

Lecture 4. Introduction to statistics, the role of statistics in research, data validation. Advantages and disadvantages of statistics.
Lecture 5. An introduction to measurement theory and errors made in scientific research.
Lecture 6. Types of measurement scales and the possibility of using statistics at different scales. Overview of statistical methods for data analysis.
Lecture 7. Rules for sampling and making observations and measurements on various natural populations.
Lecture 8. Digitization and preparation of empirical data for statistical analysis in various statistical programs.
Lecture 9. Experience as a method of research in the natural sciences.
Lecture 10. Classification of experiments according to various criteria: place of conduct and experimental unit, number of factors studied, experimental arrangement (method of randomization), repetition in place and in seasons (series of experiments).
Lecture 11. Basic principles of conducting experiments in the laboratory, vegetation hall and field. Creating research plans.
Lecture 12. Division and characteristics of research methods in the natural sciences: observation method, exact experiment method, survey method and interview method.
Lecture 14. Types of questions, questionnaire construction, determination of the sample size and the method of its selection (random, systematic, stratified, group selection). Preparing data for analysis.
Lecture 15. Selection (and justification) of the research problem, aspects of research problems and separation of research tasks. Cognitive and utilitarian goals in the natural sciences. Research concepts in the discipline of agriculture and horticulture. Concept of research in the discipline of animal husbandry and fisheries.

Disciplines of engineering and technical sciences
dr hab. inż. Adam Lipski, prof. PBŚ

Lecture 1. Introduction to the problem of planning experiments. A brief historical outline. Object of research as a source of data. Classification of quantities characterizing the object of study. Mathematical model and function of the object of study.
Lecture 2. Stages of implementation and analysis Results experiment plans. Classification and characterization of experiment plans. General criteria for selecting an experiment plan.
Lecture 3-5. Impact materiality studies. Objectives. Types of plans, their characteristics and construction. Examples of preparation, implementation and processing of experimental results.
Lecture 6-8. Complete plans. Objectives. Types of plans, their characteristics and construction. Examples of preparation, implementation and processing of experimental results.
Lecture 9-11. Selection plans. Objectives. Types of plans, their characteristics and construction. Examples of preparation, implementation and processing of experimental results.
Lecture 12-14. Optimization plans. Objectives. Types of plans, their characteristics and construction. Examples of preparation, implementation and processing of experimental results.
Lecture 15. Selected aspects of methodology and experiment planning. Summary.

3. TEACHING METHODS

multimedia lecture, demonstration, discussion, lecture, case method
sem. I lecture (15 hours)
sem. II lecture (30 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	

P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) methodology of scientific research in the field of natural and engineering-technical disciplines
SKILLS: can	
P8S_UW_a	Use of knowledge – problems solved and tasks performed a) Can creatively use knowledge of research methodology to identify, formulate and innovatively solve research tasks in the field of natural sciences and engineering and technology. Is able to prepare an individual research plan, i.e. a concept of own research, in which it includes the objectives and objects of scientific research, working hypotheses, research methods with the scope of measurements, as well as research techniques and tools.
P8S_UW_b	Use of knowledge – problems solved and tasks performed b) Can use methods of analysis and evaluation of scientific research results in order to verify research hypotheses, critically conduct conclusions.
SOCIAL COMPETENCE: is ready to	
P8S_KK_c	Evaluations – a critical approach c) recognizing the importance of knowledge in solving cognitive and practical problems in the field of a group of natural and engineering-technical disciplines and their contribution to the development of scientific knowledge.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Egzamin ustny	Written exam	Colloquium	Presentation	Project	…
P8S_WG_c		X				
P8S_UW_a					X	
P8S_UW_b					X	
P8S_KK_c					X	

6. LITERATURE

Basic Literature

Disciplines of natural sciences
prof. dr. hab. inż. Anna Wenda-Piesik

1. Uwe Flick. Projektowanie badania jakościowego, Tytuł oryginalny: Designing Qualitative Research. Warszawa, 1, 2020, Wydawca: Wydawnictwo Naukowe PWN.
2. Steinar Kvale. Prowadzenie wywiadów. Warszawa, 1, 2020, Wydawca: Wydawnictwo Naukowe PWN.
3. David Silverman. Prowadzenie badań jakościowych. 2020, Wydawca: Wydawnictwo Naukowe PWN.
4. Stefan Nowak. Metodologia badań społecznych. Warszawa, 2012, Wydawca: Wydawnictwo Naukowe PWN.
5. Graham Gibbs. Analizowanie danych jakościowych. Tytuł oryginalny: Analyzing Qualitative Data. Wydanie: Warszawa, 1, 2011. Wydawca: Wydawnictwo Naukowe PWN
6. Zbigniew Bokszański. Indywidualizm a zmiana społeczna. Wydanie: Warszawa, 1, 2007, Wydawca: Wydawnictwo Naukowe PWN
7. David Silverman. Interpretacja danych jakościowych. Wydanie: Warszawa, 1, 2020

8. Wydawca: Wydawnictwo Naukowe PWN
9. Henryk Grabowski. Wykłady z metodologii badań empirycznych. Warszawa 2014. Wydawnictwo Impuls.

Disciplines of engineering and technical sciences
dr hab. inż. Adam Lipski, prof. PBŚ

1. Polański Z., 1984. Planowanie doświadczeń w technice. PWN, Warszawa.
2. Kukiełka L., 2002. Podstawy badań inżynierskich. PWN, Warszawa.

Additional Literature

Disciplines of natural sciences
prof. dr. hab. inż. Anna Wenda-Piesik

1. Franfort-Nachmias Ch, Nachmias D. 2002. Metody badawcze w naukach społecznych. Wydawnictwo Zysk i S-ka, Poznań.
2. Meissner W. 2010. Przewodnik do ćwiczeń z przedmiotu. Metody statystyczne w biologii. W UG, Gdańsk.

Disciplines of engineering and technical sciences
dr hab. inż. Adam Lipski, prof. PBŚ

1. Korzyński M., 2006. Metodyka eksperymentu. Planowanie, realizacja i statystyczne opracowanie wyników eksperymentów technologicznych. WNT, Warszawa.
2. Pająk E., Wieczorowski K., 1982. Podstawy optymalizacji operacji technologicznych w przykładach. PWN, Warszawa.
3. Mańczak K., 1976. Technika planowania eksperymentu. WNT, Warszawa.
4. Rekab K., Shaikh M., 2005. Statistical Design of Experiments with Engineering Approach. Chapman & Hall/CRC. Taylor & Francis Group.
5. Jiju A., 2003. Design of Experiments for Engineers and Scientists. Butterworth-Heinemann.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	2
Item Name	**NUMERICAL METHODS**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Dariusz Skibicki

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
I	**15**	prof. dr hab. inż. Dariusz Skibicki

Lecture 1. Floating-point arithmetic in information technology. Computer errors, truncation errors and rounding errors.
Lecture 2. Linear matrix algebra. Basic properties of matrices. Solving systems of linear equations, exact methods, iterative methods.
Lecture 3. Linear and nonlinear approximation of one and many variables. Measures to assess the quality of approximation.
Lecture 4. Interpolation. Newtonian and Lagrange interpolation polynomials. Applications of interpolation in computer graphics – parametric interpolation.
Lecture 5. Numerical integration. Trapezoid and Simpson principle, Gaussian quadrature. Numerical differentiation. Forward, backward, and centered methods.
Lecture 6. Solving equations and systems of nonlinear equations. Chord and bisection method. The Newton-Raphson method in relation to solving a nonlinear equation and a system of nonlinear equations.
Lecture 7. Solving differential equations. Initial issues. Euler, Heun and Runge-Kutt methods. Boundary issues. Finite Difference Method. Finite Element Method.

3. TEACHING METHODS

Lecture - 15 hours
A multimedia lecture with a demonstration of issues and methods using a spreadsheet.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) methodology of scientific research in the field of the use of numerical methods
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge of numerical methods and creatively apply them to solve problems and perform research tasks
P8S_UW_b	Knowledge use – problems solved and tasks performed

	b) critically analyze and evaluate the results of scientific research, expert activity and other creative work using numerical methods
SOCIAL COMPETENCE: is ready to	
P8S_KK_c	Evaluations – a critical approach c) recognizing the importance of knowledge in the field of numerical methods in solving cognitive and practical problems,

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Egzamin ustny	Written exam	Colloquium	Presentation	…	…
P8S_WG_c			X			
P8S_UW_a			X			
P8S_UW_b			X			
P8S_KK_c			X			

6. LITERATURE

Basic Literature
1. Skibicki D., Nowicki K., Metody numeryczne w budowie maszyn, Wydawnictwa Uczelniane Akademii Techniczno-Rolniczej w Bydgoszczy, 2006
Additional Literature
1. Chapra, Steven C., Canale, Raymond P., Numerical Methods for Engineers. McGraw Hill Education 7th ed, New York 2015.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	3
Item Name	**RHETORIC**
Course coordinator responsible for preparing the syllabus	dr inż. Marta Kładź-Kocot

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
I	**15**	Marta Kładź-Kocot, PhD

1. Rhetoric as *ars bene dicendi*.
2. A history of rhetoric.
3. Figures and rhetorical tropes.
4. Composition of a rhetorical statement.
5. The concepts of persuasion and manipulation.
6. Argumentative methods and techniques.
7. Effective persuasion techniques.
8. Self-presentation techniques and the art of public speaking

3. TEACHING METHODS

Lecture – 15 hours
Multimedia lecture, discussion, lecture

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
SKILLS: can	
P8S_UK_a	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language a) using argumentative methods and techniques, communicate on specialist topics to the extent that allows active participation in the international scientific community
P8S_UK_b	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language b) use the techniques of self-presentation and the art of public speaking to disseminate the results of scientific activity, also in popular forms
P8S_UK_c	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language c) knowing effective techniques of persuasion, initiate a debate
P8S_UK_d	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language

	d) knowing argumentative methods and techniques, participate in scientific discourse

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Egzamin ustny	Written exam	Colloquium	Presentation	Project	…
P8S_UK_a				X		
P8S_UK_b				X		
P8S_UK_c				X	X	
P8S_UK_d				X	X	

6. LITERATURE

Basic Literature

1. Barłowska M., Budzyńska-Daca A., Wilczek P. (red), 2008, *Retoryka*, Wydawnictwo Naukowe PWN.
2. Korolko M., 1990, *Sztuka retoryki. Przewodnik encyklopedyczny*, Wiedza Powszechna.
3. Barłowska M., Budzyńska Daca A., Załęska M., 2010, *Ćwiczenia z retoryki*, Wydawnictwo Naukowe PWN.
4. Budzyńska-Daca A., Kwosek J., 2009, *Erystyka, czyli o sztuce prowadzenia sporów*, Wydawnictwo Naukowe PWN.
5. Beck G., 2010, *Wyższa szkoła skutecznej retoryki*, Wydawnictwo Helion.
6. Beck G., 2007, *Zakazana retoryka. Podręcznik manipulacji*, Wydawnictwo Helion.

Additional Literature

1. Meyer M., Carrilho M. M., Timmermans B., 2010, *Historia retoryki od Greków do dziś*, Wydawnictwo Aletheia.
2. Schopenhauer A., *Erystyka, czyli sztuka prowadzenia sporów*, wyd. dowolne.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	4
Item Name	**ENGLISH LANGUAGE IN SCIENCE**
Course coordinator responsible for preparing the syllabus	dr inż. Marta Giersz

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
I	**15***	Disciplines of engineering and technical sciences Marta Giersz, PhD Disciplines of natural sciences mgr Małgorzata Borowska

*subject taught separately in a discipline or group of disciplines

Disciplines of engineering and technical sciences
dr inż. Marta Giersz

1. Great scientists and their discoveries.
2. The most important inventions and their application.
3. Causes of equipment failure in various industrial fields (chemical, power plants, transportation, aviation) examples of failures due to fatigue

Disciplines of natural sciences
mgr Małgorzata Borowska

1. Water and air pollution.
2. Renewable energy.
3. Soil erosion.

II	**15***	Disciplines of engineering and technical sciences Marta Giersz, PhD Disciplines of natural sciences Małgorzata Borowska, MA

*subject taught separately in a discipline or group of disciplines

Disciplines of engineering and technical sciences
dr inż. Marta Giersz

1. Basic issues in the field of mechanics.
2. Technology in communication.
3. Technology in business.

Disciplines of natural sciences
mgr Małgorzata Borowska

1. Endangered species.
2. Recycling.
3. Waste management.

III	**15***	Disciplines of engineering and technical sciences Marta Giersz, PhD Disciplines of natural sciences Małgorzata Borowska, MA

*- subject taught separately in a group of disciplines

Disciplines of engineering and technical sciences
dr inż. Marta Giersz

1. Modern materials in various areas of life.
2. Sustainable development and ecology in various areas of life.
3. Articles and scientific presentations.

Disciplines of natural sciences
mgr Małgorzata Borowska

1. Nutrition and GMOs.
2. Enzymes and hormones.
3. Horticulture.

IV	**15E***	Disciplines of engineering and technical sciences Marta Giersz, PhD Disciplines of natural sciences Małgorzata Borowska, MA

Yes - egzamin
*- subject taught separately in a group of disciplines

Disciplines of engineering and technical sciences
dr inż. Marta Giersz

1. Work, health and safety (CV and cover letter writing, job interview)
2. Presentations and public speaking in English.
3. Formal written forms.
4. Different styles of writing scientific papers, scientific articles, presenting research at a conference.

Disciplines of natural sciences
mgr Małgorzata Borowska

1. Landscape design and architecture.
2. Composting and mulching.
3. Fertilizers.
4. Different styles of writing scientific papers, scientific articles, presenting research at a conference.

3. TEACHING METHODS

Classes conducted in the form of laboratory exercises - work with the textbook and original materials, presentation, translations, didactic games, brainstorming, discussion
Sem. I Laboratory exercises (15 hours)
Sem. II Laboratory exercises (15 hours)
Sem. III Laboratory exercises (15 hours)
Sem. IV Laboratory exercises (15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
SKILLS: can	
P8S_UK_a	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using English a) knowing the professional concepts in the field of a group of natural and engineering and technical disciplines, communicate on specialist topics to the extent that allows active participation in the international scientific community, in particular various styles of writing scientific papers, scientific articles, during public speeches and presenting research at conferences.
P8S_UK_e	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using English e) knowing professional terms in the field of a group of natural and engineering and technical disciplines, use English at the B2 level of the Common European Framework of Reference for Languages to a degree that allows participation in the international scientific and professional environment and during public speeches and scientific conferences conducted in English, as well as in scientific publications, etc.
SOCIAL COMPETENCE: is ready to	

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral Statement	Written submission	Written credit for the exercises	Presentation		
P8S_UK_a	X	X	X	X		
P8S_UK_e	X	X	X	X		

6. LITERATURE

Basic Literature

Disciplines of engineering and technical sciences
dr inż. Marta Giersz

1. Armer, T., 2011. Cambridge English for Scientists. Cambridge University Press
2. Ibbotson, M. 2009. Cambridge English for Engineering. Cambridge University Press

Disciplines of natural sciences
mgr Małgorzata Borowska

1. Armer, T., 2011. Cambridge English for Scientists. Cambridge University Press
2. Borowska, M., 2010. Animal Breeding and Biology: Professional English Textbook. University Publishing House of the University of Technology in Bydgoszcz.
3. Burczyk, K., 2008. English Texts: Agriculture and Animal Breeding. University Publishing Houses UTP in Bydgoszcz

Additional Literature

Disciplines of engineering and technical sciences
dr inż. Marta Giersz

1. Gałgańska B., 2010. Mechanical Devices Make Life Easier. University Publishing Houses UTP.
2. Otto B & M., 2005 Here is the News 1, 2, Oxford University Press
3. Thaine, C., 2020 Cambridge Academic English, Cambridge

Disciplines of natural sciences
mgr Małgorzata Borowska

1. Otto, M., B., 2007, Here is the news, Part 1. Poltex.
2. Kloc, E., 2009. English for Students of Horticulture. Publishing House of the University of Agriculture in Krakow

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	5
Item Name	**ESSENTIAL INFORMATION ON GRANTS**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Michał Choraś

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
II	**15**	prof. dr hab. inż. Michał Choraś dr hab. inż. Jolanta Tomaszewska, prof. PBŚ

During the course, students have the opportunity to see real national and EU applications submitted (won and lost) and their reviews. Students have the opportunity to see application forms for current competitions (e.g. Horizon Europe).

In addition, the following are discussed:

1. Formal aspects of the grant application: types of programmes, types of projects, budget and eligible costs in projects, division of costs by the purpose of expenditure (direct/indirect/other), basis for the evaluation of the application.
2. Aspects of building a consortium in grant projects: consortium initialization, meetings/events helpful in establishing consortia, where it is worth attending, types of partners, geographical balance and competences, division of roles in the project.
3. Aspects related to communication and work in a multicultural environment, tools helpful in working on research conclusions.
4. Substantive parts of the grant application:

– Formulation of the research problem, analysis of the current state of knowledge in the area of the requested grant, setting research goals (also going beyond the current state), definition of key performance indicators
– Research implementation – aspects of planning with the use of project management tools (PERT and Gantt diagrams), division of work into packages, identification of milestones, estimation of the workload needed to achieve them, risk analysis, budget shaping
– Assessment of the impact of research work on the scientific community and society - identification of end users, aspects of dissemination of results (identification of channels and content) and business modeling (commercialization), interdisciplinarity.
– Ethical aspects, privacy, data protection, GDPR, social aspects of research, gender aspects, security aspects
– The role of the coordinator, the role of the partner, aspects related to the effective management of research projects

3. TEACHING METHODS

Lecture – 15 hours multimedia lecture

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_d	Scope and depth – completeness of cognitive perspective and dependencies d) the principles of dissemination of the results of scientific activity, thanks to the knowledge of end users and channels for the dissemination of the results of scientific work,
P8S_WK_c	Context – conditions, effects c) learning about the aspects of building a consortium in grant projects, learns the basic principles of knowledge transfer to the economic and social spheres
SKILLS: can	
P8S_UW_c	Knowledge use – problems solved and tasks performed c) use knowledge to build consortia and submit project proposals that solve specific problems and tasks
P8S_UO_a	Work organization – planning and teamwork a) knowing the issues of implementation of scientific research in projects, plan and implement individual and team research or creative projects, also in an international environment
SOCIAL COMPETENCE: is ready to	
P8S_KO_a	Responsibility – fulfilling social obligations and acting for the public interest a) being aware of the impact of research work on the scientific community and society, fulfilling the social obligations of researchers and creators
P8S_KO_b	Responsibility – fulfilling social obligations and acting for the public interest b) being aware of the impact of research work on the scientific community and society, understanding the ethical aspects of
P8S_KO_c	Responsibility – fulfilling social obligations and acting for the public interest c) knowing the aspects of effective management of research projects, is ready to think and act in a team and project manner

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Egzamin ustny	Written exam	Colloquium	Project	…
P8S_WG_d				X	
P8S_WK_c				X	
P8S_UW_c				X	
P8S_UO_a				X	
P8S_KO_a				X	
P8S_KO_b				X	
P8S_KO_c				X	

6. LITERATURE

Basic Literature
-
Additional Literature
-

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	6
Item Name	**CONTEMPORARY TRENDS IN THE DEVELOPMENT OF SCIENCE**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Maria Siwek-Gapińska

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
II	**15**	prof. dr hab. inż. Dariusz Boroński prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Magdalena Stanek, prof. PBŚ dr hab. inż. Mirosław Banaszak, prof. PBŚ dr hab. inż. Maciej Walkowiak, prof. PBŚ prof. dr hab. inż. Anna Wenda-Piesik dr inż. Piotr Kiedrowski

prof. dr hab. inż. Dariusz Boroński

1. Autonomous machines - cars, planes, household appliances and others.
2. Robotization and automation - application in industry and medicine.
3. Zero-emission drives - used in cars, planes, seagoing vessels.
4. Renewable energy sources and their application in the construction of passive technical facilities.
5. Bionics in mechanical engineering.
6. Modern materials and their application.
7. 3D printing.

III	**15**	prof. dr hab. inż. Dariusz Boroński prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Magdalena Stanek, prof. PBŚ dr hab. inż. Mirosław Banaszak, prof. PBŚ dr hab. inż. Maciej Walkowiak, prof. PBŚ prof. dr hab. inż. Anna Wenda-Piesik dr inż. Piotr Kiedrowski

prof. dr hab. inż. Maria Siwek-Gapińska (coordinator)

1. The gastrointestinal tract and its microbiome - the "heart of immunity" (prof. dr hab. inż. Maria Siwek-Gapińska)
2. Biochemistry as an interdisciplinary science (dr hab. inż. Magdalena Stanek, prof. PBŚ)
3. Nutritional value of fish meat and its consumption (dr hab. inż. Magdalena Stanek, prof. PBŚ)
4. Genomics in the optimization of animal husbandry (prof. dr hab. inż. Maria Siwek-Gapińska).
5. "omics" technologies and their application in livestock research. (prof. dr hab. inż. Maria Siwek-Gapińska)
6. The importance of biosecurity for humans (dr hab. inż. Mirosław Banaszak, prof. PBŚ).
7. Market trends as determinants in animal production. (dr hab. inż. Mirosław Banaszak, prof. PBŚ)

IV	**15**	prof. dr hab. inż. Dariusz Boroński prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Magdalena Stanek, prof. PBŚ dr hab. inż. Mirosław Banaszak, prof. PBŚ dr hab. inż. Maciej Walkowiak, prof. PBŚ prof. dr hab. inż. Anna Wenda-Piesik dr inż. Piotr Kiedrowski
dr hab. inż. Maciej Walkowiak, prof. PBŚ 1. 5G and 6G networks 2. Internet of Things 3. Artificial intelligence 4. Spaceship or canoe – continuation of the discussion on cybersecurity 5. Electromagnetism in the cognition of man and the universe 6. Human interaction with electromagnetic fields 7. Electromagnetic compatibility as an element of ecology		
V	**15**	prof. dr hab. inż. Dariusz Boroński prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Magdalena Stanek, prof. PBŚ dr hab. inż. Mirosław Banaszak, prof. PBŚ dr hab. inż. Maciej Walkowiak, prof. PBŚ prof. dr hab. inż. Anna Wenda-Piesik dr inż. Piotr Kiedrowski
prof. dr hab. inż. Anna Wenda-Piesik 7 meetings, each of which will discuss different issues of modern trends in engineering and technical sciences and in natural sciences on the basis of the latest reports from "Nature" (IF=38) and "Science" (IF=41), i.e. publications with the highest impact index in science. The topics will concern technology, the concept of know-how, in the development of civilization. The assumption of such a series is to track progress, hence the topics will be updated every year.		

3. TEACHING METHODS

sem. II lecture - 15 hours
sem. III lecture - 15 hours
sem. IV lecture - 15 hours
sem. V lecture - 15 hours.
multimedia lecture, discussion

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – global achievements, including theoretical foundations and general issues and selected

	specific issues, specific to the group of natural and engineering and technical disciplines
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) main development trends in the groups of natural sciences and engineering-technical disciplines. Understands the relationships and dependencies of research problems of the disciplines represented in the doctoral school.
P8S_WK_a	Context – conditions, effects a) fundamental dilemmas of modern civilization characteristic of the group of natural and engineering-technical disciplines
P8S_WK_b	Context – conditions, effects b) economic, legal, ethical and other important determinants of scientific activity characteristic of the group of natural and engineering and technical disciplines
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from the group of natural and engineering and technical disciplines to creatively identify and formulate the goals and objects of scientific research
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements within the group of natural and engineering and technical disciplines
P8S_KK_b	Evaluations – a critical approach b) critically evaluate their own contribution to the development of the discipline against the background of the group of natural and engineering and technical disciplines

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a					X	X
P8S_WG_b					X	X
P8S_WK_a					X	X
P8S_WK_b					X	X
P8S_UW_a					X	X
P8S_KK_a					X	X
P8S_KK_b					X	X

6. LITERATURE

Basic Literature

Semester II

prof. dr hab. inż. Dariusz Boroński

1. K. T. Chau. Electric Vehicle Machines and Drives: Design, Analysis and Application. Wiley-IEEE Press, 2015. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&db=edsebk&AN=993140&lang=pl&site=eds-live.
2. Bruce Usher. Renewable Energy: A Primer for the Twenty-First Century. Columbia University Press, 2019. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1946704&lang=pl&site=eds-live.
3. Messner, William C. Autonomous Technologies: Applications That Matter. SAE International, 2014.

EBSCOhost, search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1805014&lang=pl&site=eds-live.
4. Herrmann, Andreas, et al. Autonomous Driving: How the Driverless Revolution Will Change the World. Emerald Publishing Limited, 2018. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1579295&lang=pl&site=eds-live.
5. George A Bekey, et al. Robotics: State Of The Art And Future Challenges. Imperial College Press, 2008. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=516770&lang=pl&site=eds-live.
6. Zukas, Victoria, and Jonas A. Zukas. An Introduction to 3D Printing. First Edition Design Publishing, 2015. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1003128&lang=pl&site=eds-live.

Semester III
prof. dr hab. inż. Maria Siwek-Gapińska

1. Preeti A., and Misra G., eds. Omics Approaches, Technologies and Applications: Integrative Approaches for Understanding OMICS Data. Springer, 2019.
2. De Heus: Hulsen, Jan, and Kees Scheepens. Pig Signals: Look, Think and Act. Roodbont, 2006.
3. Pueyo Montesinos G. del.: Rehabilitacja i fizjoterapia w weterynarii. 2017. Elsevier Urban & Partner, Wrocław.
4. Pevsner J., Bioinformatics and functional genomics. 2015. Third edition. Chichester, West Sussex, UK : Wiley-Blackwell
5. Stryer L., Berg J.M, Tymoczo J.L. „Biochemia", 2018. Wyd. Nauk. PWN, Warszawa

Semester IV
dr hab. inż. Maciej Walkowiak, prof. PBŚ

1. Dott Annabel Z.: *Essential Guide to Telecommunication.* Pearson Education (US), 2018
2. Smith Kameron: *Telecommunications Essentials*. Clanrye International, 2019
3. Penttinen Jyrki T. J.: *5G Explained - Security and Deployment of Advanced Mobile Communications*. Wiley, 2019
4. *Smart Grid and Internet of Things*. Second EAI International Conference, SGIoT 2018, Niagara Falls, ON, Canada, July 11, 2018
5. Mohesen Guizani , Hsiao-Hwa Chen , Chonggang Wang: *The Future of Wireless Networks: Architectures, Protocols, and Services (Wireless Networks and Mobile Communications)*. CRC Press, 2015
6. Battocletti Joseph H.: *Electromagnetism, Man and the Environment*. Routledge, 2019
7. Clayton R. Paul: *Introduction to Electromagnetic Compatibility*. Wiley-Interscience; 2 edition, 2006

Semester V
prof. dr hab. inż. Anna Wenda-Piesik
Journal Science
Journal Nature

Additional Literature

Semester II
prof. dr hab. inż. Dariusz Boroński
- electronic sources available in the PBS Main Library

Semester III
prof. dr hab. inż. Maria Siwek-Gapińska

1. Bockstahler B., Levine D., Millis D.: Fizjoterapia psów i kotów. Rehabilitacja i zwalczanie bólu. 2004. Wyd. Galaktyka
2. Martin P., Bateson P. Measuring behaviour. An introductory guide. 2007. Cambridge University Press.
3. Margit H. Zeitler-Feicht. Zachowania koni. Przyczyny, terapia i profilaktyka. 2014. Świadome Jeździectwo, Warszawa.
4. Cattle behaviour. http://www.publish.csiro.au/ebook/chapter/9781486301614_Chapter4
5. Pig behaviour. https://www.farmhealthonline.com/health-welfare/pigs/pig-behaviour/
6. Animal Behaviour Net. https://www.animalbehaviour.net/
7. Adamczyk K., Górecka-Bruzda A., Nowicki J., Gumułka M., Molik E., Schwarz T., Earley B., Klocek C. 2015 – Perception in farm animals – a review. Annals of Animal Science 15, 565-589.
8. Temple Grandin. Zrozumieć zwierzęta. 2011. Media Rodzina, Poznań.
9. Levine D., Millis D.L., Taylor R.A.: Rehabilitacja psów. 2016. Edra Urban&Partner, Wrocław.
10. Robertson J., Mead A.: Fizjoterapia i masaż psów. 2017 Galaktyka, Łódź.
11. Kinalski R.: Neurofizjologia kliniczna dla neurorehabilitacji. Podręcznik dla studentów i absolwentów wydziałów fizjoterapii. 2008. Med Pharm Polska.
12. Minakowski W., Weidner S., „Biochemia kręgowców", Wyd. Nauk. PWN, Warszawa 2005.
13. Murray R.K., Granner D.K., Mayes P.A., Podwell V.W., „Biochemia Harpera", Wyd. Lek. PZWL, Warszawa 2016
14. Kączkowski J., „Podstawy biochemii", Wyd. Nauk. Techn., Warszawa 2017.
15. Kupcewicz B., Roślewska A., Stanek M., Stasiak K., „Materiały do ćwiczeń i seminariów z biochemii", Wyd. Uczelniane ATR, Bydgoszcz 2005.
16. Strzeżek J., Wołos A., 1997, „Ćwiczenia z biochemii", Wyd. ART Olsztyn
17. https://media.wholefoodsmarket.com/news/whole-foods-market-unveils-top-10-food-trends-for-2019
18. https://www.tysonfoods.com/the-feed-blog/food-trends-2019
19. http://www.mintel.com/global-food-and-drink-trends/
20. http://ptz.icm.edu.pl/wp-content/uploads/2011/12/PH_8_2011_Mlynarczyk.pdf
21. https://www.avec-poultry.eu/resources/annual-reports/
22. https://www.geografia24.eu/geo_prezentacje_rozsz_3/383_3_rolnictwo/r3_3_03a.pdf
23. http://www.fao.org/animal-production/en/

Semester IV

dr hab. inż. Maciej Walkowiak, prof. PBŚ

It will be provided on a regular basis, during classes

Semester V

prof. dr hab. inż. Anna Wenda-Piesik

It will be provided on a regular basis, during classes

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	7
Item Name	**PREPARATION OF ARTICLES AND SCIENTIFIC PRESENTATIONS**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Beata Jędrzejewska, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
III	**15**	dr hab. inż. Beata Jędrzejewska, prof. PBŚ dr hab. inż. Ireneusz Grubecki, prof. PBŚ
Methods of searching for scientific information. Parametric tools for publications and authors, search engines for journals and scientific publications (Scopus, Web of Science, Google Scholar), Scientific Publishers, lists of scored journals. Methods of promoting scientific activity – creating online profiles (e.g. ResearchGate, ResearcherID, Google Scholar, Web of Science, ORCID), conference presentations and posters. Rules for preparing a multimedia presentation and poster – formal and technical requirements, data visualization.		
IV	**15**	prof. dr hab. inż. Elwira Śliwińska dr hab. inż. Ireneusz Grubecki, prof. PBŚ
The role of a scientific article; Objectives of publishing, types of scientific articles, selection of a journal. Editorial preparation of a scientific article – technical requirements. Word processors, spreadsheets and visualizations, graphics programs, bibliography programs, chemical and mathematical formula editors. Principles of intellectual property protection, including citing other works. Rules for the preparation of a scientific publication – formal requirements. Structure of a scientific article; the way of writing individual elements of the article: title, abstract, theoretical introduction, research methodology, discussion and discussion of results, summary and conclusions, nomenclature, etc. Sending the article to the journal and formalities after it has been accepted for printing.		

3. TEACHING METHODS

Sem. III lecture - 8 hours seminar - 7 hours
Sem. IV lecture - 8 hours seminar - 7 hours
A mixed form of classes combining a lecture and a seminar in both semesters; full-time and/or distance learning, synchronous and asynchronous; multimedia presentation; work on source materials

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) the methodology of scientific research in the field of methods of searching for scientific information,
P8S_WG_d	Scope and depth – completeness of cognitive perspective and dependencies d) the rules for disseminating the results of scientific activity and promoting scientific activity in the form of scientific publications and presentations, also in the open access mode;
SKILLS: can	
P8S_UW_b	Knowledge use – problems solved and tasks performed b) thanks to the knowledge of parametric tools of publications and authors, to critically analyze and evaluate the results of scientific research, expert activity and other creative works and their contribution to the development of knowledge
P8S_UK_b	Communication – receiving and creating statements, dissemination of knowledge in the scientific community b) knowing the methods of preparing scientific presentations and articles, disseminate the results of scientific activity, also in popular forms
SOCIAL COMPETENCE: is ready to	
P8S_KK_b	Evaluations – a critical approach b) through the knowledge of parametric tools of publications and authors, critical assessment of their own contribution to the development of a given scientific discipline
P8S_KR_a	Professional role – independence and ethos development a) maintain and develop the ethos of the research community through knowledge of the principles of citation and co-authorship in publications, understands the need to respect the principles of public ownership of the results of scientific activity, taking into account the principles of intellectual property protection.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	…	…
P8S_WG_c				X		
P8S_WG_d				X		
P8S_UW_b				X		
P8S_UK_b				X		
P8S_KK_b				X		
P8S_KR_a				X		

6. LITERATURE

Basic Literature
Semester III 1. Wasylczyk P., 2017. Prezentacje naukowe. Praktyczny poradnik dla studentów, doktorantów i nie tylko. Wydawnictwo Naukowe PWN, Warszawa. 2. Zabielski R., Godlewski M. M., 2011. Przewodnik prezentowania informacji naukowej. Katedra Nauk Fizjologicznych Wydział Medycyny Weterynaryjnej SGGW, Warszawa. 3. https://epodreczniki.pl/a/tworzenie-prezentacji/DOPPeVhVM 4. Elektroniczne zasoby licencjonowane przez PBŚ oraz ogólnodostępne bazy danych i katalogów czasopism elektronicznych. **Semester IV** 1. Liśkiewicz T., Liśkiewicz G., 2014. Wprowadzenie do efektywnego publikowania naukowego. Jak przygotować, wysłać i promować artykuł naukowy. Wydawnictwo AmberEditing, Łódź. 2. Siuda P., Wasylczyk P., Publikacje naukowe, 2018. Praktyczny poradnik dla studentów, doktorantów i nie tylko. Wydawnictwo Naukowe PWN, Warszawa. 3. Bieżące publikacje naukowe.
Additional Literature
1. Hirsch J. E., 2005. An index to quantify an individual's scientific research output. Proc. Nat. Acad, Sci. (PNAS), vol. 102, nr 46, s. 16569-16572. 2. Kozierski P. Kabaciński R., Lis M., Kaczmarek P., 2013. Open Access. Analiza zjawiska z punktu widzenia polskiego naukowca. Wyd. Impuls, Poznań - Kraków. **3.** Kulczycki E., 2013. Jak dodać prace do Google Scholar i zwiększyć liczbę cytowani oraz indeks Hirscha? Stowarzyszenie EBIB, Toruń.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	8
Item Name	**DATA ANALYSIS - STATISTICS, DATA VISUALISATION**
Course coordinator responsible for preparing the syllabus	prof. dr. hab. inż. Anna Wenda-Piesik

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
III	**15***	Disciplines of natural sciences prof. dr. hab. inż. Anna Wenda-Piesik prof. dr. hab. inż. Dariusz Piwczyński Disciplines of engineering and technical sciences dr hab. inż. Adam Lipski, prof. PBŚ dr inż. Krzysztof Nowicki

*- subject taught separately in a group of disciplines

Semester III

Disciplines of natural sciences
prof. dr. hab. inż. Anna Wenda-Piesik

1. Introduction to descriptive statistics for the sample and general population. Types of empirical distributions. Assumptions of the correctness of statistical analyses, data transformations.
2. The theory of parametric estimation and the practical application of estimators in natural research.
3. Theory and application of compatibility, randomness, and independence tests. Sample studies in terms of extreme data affiliation, uniformity of variance and normality of distribution.
4. Statistical inference methods for two populations. Diagram of the structure of the significance test, *the Student's t-test and its modifications.*
5. Stochastic relationship analyses (linear and nonlinear estimates) in two-dimensional populations.
6. Introduction to ANOVA, linear ANOVA models.
7. Graphical presentation of results from various studies in the life sciences.
8. Use of statistical packages: Statistica 13.0 and Excel spreadsheet for calculations.

Disciplines of engineering and technical sciences
dr hab. inż. Adam Lipski, prof. PBŚ

1. Object of research as a source of data. Basic methods of data presentation.
2. Descriptive statistics. Selected position and dispersion indicators.
3. Random variable. Selected discrete and continuous distributions. Random variable generation.
4. Statistical inference. Methods of determining estimators. Parametric estimation. Determination of the minimum sample size.
5. Testing statistical hypotheses. Selected statistical tests.
6. Analysis of the relationship between two quantitative variables. Correlation. Regression equation.

Confidence interval of the regression equation. Outliers and influential.
7. Application of statistical methods to quality assurance.
8. Selected information on stochastic processes.

IV	**30 E***	prof. dr. hab. inż. Anna Wenda-Piesik dr hab. inż. Adam Lipski, prof. PBŚ

E - exam
*- subject taught separately in a group of disciplines

Disciplines of natural sciences
prof. dr. hab. inż. Anna Wenda-Piesik

1. Applications of multivariate exploratory techniques in the processing of data from natural experiments (genetics, breeding) – cluster analysis (CA), dendrograms, k-means method.
2. MANOVA in the development of agricultural data and multiple comparison tests from the *post-hoc group*.
3. Applications of principal components analysis (PCA) and factor analysis (FA) in the development of natural data.
4. Multiple regression analysis and cross-linking of data from environmental studies (screenings).
5. Methods of analysis of data from surveys. Selected methods of analysis of results expressed on a nominal and ordinal scale.
6. Nonparametric tests of chi2, T-Wilcoxon, Mann–Whitney U, measures of covariance V-Cramer, t-Kendall, r-Spearman.
7. Dyskimination analysis and canonical analysis. Statistical inference and substantive inference.

Disciplines of engineering and technical sciences
dr inż. Krzysztof Nowicki

1. Regressions – simple, multiple, stepwise, nonlinear, logistic, residual analysis.
2. Elements of experience planning.
3. Analysis of variance / covariance – univariate, multivariate, hierarchical, multivariate, repeated measurements, variational components.
4. Canonical Analysis
5. Discriminant analysis
6. Cluster analysis
7. Principal components analysis
8. Factor analysis
9. Log Line Analysis

3. TEACHING METHODS

sem. III lecture - 8 hours, laboratory classes - 7 hours.
sem. IV lecture - 15 hours, laboratory classes - 15 hours.
multimedia lecture, laboratory exercises, case method, data analysis based on statistical programs

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) the scopes of methods of descriptive and mathematical statistics and the presentation of results, which are used at an advanced level as tools for data analysis in natural sciences and engineering and technology.
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use scientific knowledge in the field of data analysis and presentation to draw conclusions based on the results of scientific research,
P8S_UW_b	Knowledge use – problems solved and tasks performed b) critically evaluate research hypotheses based on the results of scientific research
SOCIAL COMPETENCE: is ready to	
P8S_KK_c	Evaluations – a critical approach (c) recognising the importance of scientific knowledge in data analysis in solving cognitive and practical problems

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Egzamin ustny	Written exam	Colloquium	Presentation	Project	…
P8S_WG_c		X				
P8S_UW_a			X		X	
P8S_UW_b			X		X	
P8S_KK_c			X		X	

6. LITERATURE

Basic Literature

Semester III

Disciplines of natural sciences

1. Wenda-Piesik A., Gałęzewski L. 2020. Kurs statystyki dla studentów kierunków przyrodniczych Uniwersytetu Technologiczno-Przyrodniczego w Bydgoszczy. S. 115, http://dlibra.utp.edu.pl/dlibra
2. Dawn Griffiths. Statystyka (tytuł w oryginale Head First Statistics). Wydawnictwo Helion S.A. Gliwice, 2010, liczba stron: 711.
3. Adam Łomnicki. Wprowadzenie do statystyki dla przyrodników, Wydawnictwo Naukowe PWN, Warszawa, wydanie 5, 2019 liczba stron: 245.
4. Mieczysław Sobczyk. Statystyka. Wydawnictwo Naukowe PWN, Warszawa, 5, 2020, liczba stron: 356.
5. Andrzej Luszniewicz, Teresa Słaby. Statystyka z pakietem komputerowym STTISTICA PL. Wydawnictwo C.H. Beck, 2008, liczba stron: 472.
6. Ryszard Błażejewski. Wstęp do badań empirycznych. Wydawnictwo Akademii Rolniczej w Poznaniu, Poznań 1999, liczba stron: 101.

Disciplines of engineering and technical sciences

1. Klonecki W., Statystyka dla inżynierów. PWN, Warszawa, 1999.
2. Hellwig Z., Elementy rachunku prawdopodobieństwa i statystyki matematycznej. PWN,

Warszawa, 1998.

Semester IV
Disciplines of natural sciences

1. Andrzej Stanisz, Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. Tom 1. Statystyki podstawowe, Wydawca: StatSoft Polska Wydanie: Kraków, 2006, number of pages: 532.
2. Andrzej Stanisz, Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny Tom 2. Modele liniowe i nieliniowe, Wydanie: Kraków, 2007, number of pages: 868.
3. Andrzej Stanisz, Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny Tom 3. Analizy wielowymiarowe, Wydanie: Wydanie: Kraków, 2007, number of pages: 500.
4. Franfort-Nachmias Ch., Nachmias D. 2002. Metody badawcze w naukach społecznych. Wydawnictwo Zysk i S-ka, Poznań, number of pages: 616.

Disciplines of engineering and technical sciences

1. Walesiak M., Gatnar E. (red.), Statystyczna analiza danych z wykorzystaniem programu R, Wydawnictwo naukowe PWN, Warszawa, 2012, number of pages: 468.

Additional Literature

Semester III
Disciplines of natural sciences

1. Meissner W. 2010. Przewodnik do ćwiczeń z przedmiotu. Metody statystyczne w biologii. W UG, Gdańsk
2. Gołaszewski J., Puzio-Idźkowska M., Stawiana-Kosiorek A., Załuski D. 2003. Statystyka dla przyrodników, Wyd. UWM, Olsztyn, number of pages: 265.
3. Sokal R, Rohlf. Biometry. W.H. Freeman and Company, New York, 1981, number of pages: 859.

Disciplines of engineering and technical sciences

1. Hyk W., Stojek Z., Analiza statystyczna w laboratorium badawczym. PWN, Warszawa, 2019.
2. Metcalfe A.V., Statistics in Engineering. A practical approach. Chapman & Hall, 1994.

Semester IV
Disciplines of natural sciences

1. Aneta Ptak-Chmielewska, Uogólnione modele liniowe, Oficyna Wydawnicza szkoła Głowna Handlowa w Warszawie, 2013, number of pages: 141.
2. Bill Shipley. Cause and correlation in Biology (A user's guide to path analysis, structural equations and causal inference). Cambridge University Press, Cambridge, 2000, number of pages: 318.
3. Norm O'Rourke, Larry Hatcher, Edward J. Stepanski. A step-by-step Approach to Using SAS for Univariate & Multivariate Statistics, SAS Institute, North Carolina, 2009, number of pages: 513.

Disciplines of engineering and technical sciences

1. Stanisz. A, Przystępny kurs statystyki, Tom 2 Modele liniowe i nieliniowe, StatSoft Polska, Kraków, 2007, number of pages: 867.
2. Stanisz. A, Przystępny kurs statystyki, Tom 3 Analizy wielowymiarowe, StatSoft Polska, Kraków, 2007, number of pages: 499.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	9
Item Name	**PHILOSOPHY OF COGNITION**
Course coordinator responsible for preparing the syllabus	dr Adam Skowron

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**10**	dr Adam Skowron

1. Philosophy of cognition - preliminary issues, definitional problems. Cognition in science and philosophy.
2. The problem of the sources of cognition - genetic and methodological approach: empiricism, rationalism, irrationalism. A dispute over the object and limits of cognition.
3. The Question of Truth in Philosophy – Classical and Non-Classical Theories of Truth. Semantic definition of truth. Deflationism and anti-deflationism.
4. The development of methodological reflection in philosophy at the turn of the nineteenth and twentieth centuries – the problem of scientific cognition – philosophy of science. Concepts of K. Popper, Th. Kuhn, P.K. Feyerabend, Duhem-Quine coherenceism.
5. The main trends of contemporary epistemology: constructivism, postmodernism, neopragmatism, naturalism, anti-naturalism.

3. TEACHING METHODS

Lecture – 10 hours
multimedia lecture - discussion

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies: a) to the extent that allows for the revision of existing paradigms – knows and understands the world's achievements, essence and conditions of problems specific to the philosophy of cognition
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies: c) the history of the formation of the contemporary methodology of scientific research
P8S_WK_a	Context – conditions, effects: a) fundamental dilemmas of modern civilization, including the problems of scientific cognition and the main directions of contemporary epistemology.

SOCIAL COMPETENCE: is ready to	
P8S_KK_c	Assessments – a critical approach: c) through methodological reflection, recognition of the importance of knowledge in solving cognitive and practical problems

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Egzamin ustny	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a		X			X	
P8S_WG_c		X			X	
P8S_WK_a		X			X	
P8S_KK_c		X			X	

6. LITERATURE

Basic Literature
1. Woleński J., 2005, Epistemologia. Poznanie, prawda, wiedza, realizm, Wydawnictwo Naukowe PWN, Warszawa. 2. Hetmański M. (red.), 2008, Epistemologia współcześnie, Universitas, Kraków. Sady W., 2000, Spór o racjonalność naukową od Poincare`go do Laudana, Monografie Fundacji na rzecz Nauki Polskiej, Wrocław.
Additional Literature
1. Heller M., 2011, Filozofia nauki. Wprowadzenie, Wydawnictwo Petrus, Kraków. 2. Morton A., 2002, Przewodnik po teorii poznania, Wydawnictwo Spacja, Warszawa.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	10
Item Name	**ETHICS IN SCIENCE**
Course coordinator responsible for preparing the syllabus	dr Adam Skowron

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**5**	dr Adam Skowron

Traditional and contemporary understanding of the university's mission and the ethos of science. The role of ethics in the twenty-first century pragmatics of scientific life.
Ethical neutrality and freedom of science (freedom of scientists) and the moral responsibility of the researcher, the scholar.
Institutionalization of ethics in science: Code of Ethics for Researchers, Good Practice in Scientific Research, Good Practices in Science, European Charter for Researchers.
Using research results as an ethical problem. Ethics in the face of civilizational challenges and threats resulting from new forms of organization and financing of research.

3. TEACHING METHODS

Lecture – 5 hours
multimedia lecture - discussion

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_b	Context – conditions, effects b) economic (research financing), formal and legal and ethical (codes of ethics) determinants of scientific activity
SKILLS: can	
P8S_UW_b	Use of knowledge – problems solved and tasks performed: b) perform a critical ethical analysis of the results of scientific research, expert activities and other creative works and assess their significance for the development of knowledge.
P8S_UU_a	Learning – planning your own development and the development of others: a) independently plan and ethically implement their own scientific program and inspire and organize the development of others
SOCIAL COMPETENCE: is ready to	
P8S_KO_a	Responsibility – fulfilling social obligations and acting for the public interest: a) understanding the mission of the university and the ethos of science, fulfilling the social obligations faced by researchers and creators.

P8S_KO_b	Responsibility – fulfilling social obligations and acting for the public interest: b) understanding the mission of the University and the ethos of science, initiating activities for the public interest
P8S_KR_a	Professional role – independence and ethos development: a) maintaining and developing the ethos of research and creative communities, namely conducting scientific activity in an independent manner (freedom of scientists), respecting the principle of public ownership of the results of scientific activity, taking into account the principles of intellectual property protection

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Egzamin ustny	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WK_b					X	
P8S_UW_b					X	
P8S_UU_a					X	
P8S_KO_a					X	
P8S_KO_b					X	
P8S_KR_a					X	

6. LITERATURE

Basic Literature

1. Chmielecka E., Jedlicki J., Rychard A. (red), 2005, Ideały nauki i konflikty wartości, IFiS PAN, Warszawa.
2. Galewicz Wł., 2009, Etyczne i prawne granice badań naukowych, Uniwersitas Kraków.
3. Morawski R. Z., 2011, Etyczne aspekty działalności badawczej w naukach empirycznych, Wydawnictwo UW Warszawa.

Additional Literature

1. Kodeks Etyki Pracownika Naukowego, 2017, Komisja do spraw etyki w nauce PAN, Warszawa.
2. Dobra Praktyka Badań Naukowych, Rekomendacje, 2004, Warszawa.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.I
Item Name	**General elective subjects block** **RESEARCH AND DEVELOPMENT IN ENTERPRISES**
Course coordinator responsible for preparing the syllabus	a person from the economic environment

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**15**	A person from an economic background
During the lectures, people representing companies operating within the disciplines represented in the Doctoral School will present research methods and development strategies of individual enterprises.		

3. TEACHING METHODS

Classes are held in the form of a lecture and a seminar.
Lecture – 8 hours
Seminar – 7 hours

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic sphere and commercialization of the results of scientific activity and know-how related to these results, within the disciplines represented in the doctoral school
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from the group of natural and engineering and technical disciplines to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the economic environment
P8S_UW_c	Knowledge use – problems solved and tasks performed c) transfer the results of scientific activity in the field of natural sciences and engineering and technology to the economic sphere
P8S_UK_b	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language

	b) disseminate the results of scientific activity, also in forms popular for the needs of the economic environment
P8S_UK_c	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language c) initiate a debate in the economic environment
P8S_UO_a	Work organization – planning and teamwork a) plan and implement individual and team research or creative projects in the economic environment
P8S_UU_a	Learning – planning your own development and the development of others a) independently plan and act for their own development and inspire and organize the development of other people from the economic environment
P8S_UU_b	Learning – planning your own development and the development of others b) plan classes or groups of classes and carry them out with the use of modern methods and tools of people from the economic environment
SOCIAL COMPETENCE: is ready to	
P8S_KO_c	Responsibility – fulfilling social obligations and acting for the public interest c) thinking and acting in an entrepreneurial way in cooperation with the economic environment
P8S_KR_a	Professional role – independence and ethos development maintaining and developing the ethos of research and creative communities in the economic environment

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WK_c					X	
P8S_UW_a					X	
P8S_UW_c					X	
P8S_UK_b					X	
P8S_UK_c					X	
P8S_UO_a					X	
P8S_UU_a					X	
P8S_UU_b					X	
P8S_KO_c					X	
P8S_KR_a					X	

6. LITERATURE

Basic Literature
It will be provided on a regular basis, during classes
Additional Literature

It will be provided on a regular basis, during classes

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.II
Item Name	**General elective subjects block** **HIGHER SCHOOL DIDACTICS WITH ELEMENTS OF METHODOLOGY**
Course coordinator responsible for preparing the syllabus	dr Magdalena Zając

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**15**	dr Magdalena Zając

Higher education as a science. The essence, issues and functions and its place among pedagogical sciences. Contemporary student - characteristics of Generation Z. Characteristics of early adulthood:
(theories: D. Levinson, R. Gould, E. Erikson). Young adults - psychophysical, cognitive, social, emotional and moral development; regularities and determinants of the learning process from adolescence to early adulthood, forms of adult activity. Expanding autonomy and self-reliance. Socialization and social position in a student group. The role of significant people and authorities – the teacher's authority. Ambitions and aspirations. Motivation. Specificity and regularities of learning in young adults. Cognitive styles and learning strategies vs. teaching styles in higher education. A modern academic teacher.
Qualifications, competences and the role of an academic teacher. Student-teacher interactions throughout the classroom. Student group dynamics: student collaboration and cooperation. Stimulating the cognitive activity of students, creating didactic situations, managing the work of students.

3. TEACHING METHODS

lecture, group discussion

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_c	Knows and understands: The relationship between the quality of teaching at the university level and the effectiveness of the use of knowledge by students in their professional activities
SKILLS: can	
P8S_UW_a	Can: Recognize the didactic situation in the context of the teacher-student relationship and plan interactions based on the results of scientific research in the humanities and social sciences
P8S_UW_c	Can By means of didactic techniques, transfer the results of scientific activity to the economic and social sphere
P8S_UK_b	Can:

	In a manner consistent with the knowledge of the social sciences and humanities, formulate statements that allow for a wider dissemination of the results of scientific activity
P8S_UK_c	Can: In a manner consistent with the knowledge in the field of social sciences and humanities, initiate and conduct a debate and discussion of the results of scientific activities
P8S_UO_a	Is able to plan and implement individual and team research or creative projects with the participation of university students, also in an international environment, in a manner worthy of the principles of didactics.
P8S_UU_a	Can independently design the path of his/her own professional development, also as a teacher, as well as the path of professional and scientific development of the student
P8S_UU_b	Is able to plan classes or groups of classes on the basis of knowledge in the field of humanities and social sciences and implement them using modern methods and tools
SOCIAL COMPETENCE: is ready to	
P8S_KO_c	Is ready to self-reflect on their own professional development in the context of their environmental role
P8S_KR_a	Is ready to use universal ethical principles and standards in professional activity,

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WK_c					X	
P8S_UW_a					X	
P8S_UW_c					X	
P8S_UK_b					X	
P8S_UK_c					X	
P8S_UO_a					X	
P8S_UU_a					X	
P8S_UU_b					X	
P8S_KO_c					X	
P8S_KR_a					X	

6. LITERATURE

Basic Literature
Brzezińska A., Brzeziński J., Ewaluacja procesu kształcenia w szkole wyższej, Poznań, 2000. Bereźnicki F., Zagadnienia dydaktyki szkoły wyższej, Szczecin 2009 Cottrell S., Podręcznik umiejętności studiowania, Poznań 2007; Jaskot H.W. (red.), Wprowadzenie do pedagogiki szkoły wyższej, Szczecin 2006. Michałowska D.A., Wartości w świecie edukacji na początku XXI wieku,Wyd. Naukowe WNS UAM, Poznań 2013. Kubiak-Szymborska, E., Nauczyciele akademiccy – studenci. Między partnerstwem a pozorną stycznością, Bydgoszcz, 2005 Legowicz J., The University Teacher. Professional ethos and educational model, „Życie szkoły wyższej", R XXXIV, 1986, s. 155-173 Lewowicki T., Proces kształcenia w szkole wyższej, Warszawa 1988;

Sitarska B., (red.), Jakość kształcenia w szkole wyższej moda czy konieczność? Siedlce 2000;
Szewczuk K., Metody dydaktyczne stosowane w szkole wyższej, Kraków 2013
Wykładowca doskonały. Podręcznik nauczyciela akademickiego, red. A. Rozmus, Warszawa 2010.

Additional Literature

Arends, R. (1994). Uczymy się nauczać. Warszawa.
Barnes, D. (2004) Nauczyciel i uczniowie. Od porozumiewania się do kształcenia. Warszawa.
L. B. Curzon, J. Tummons (2013) Teaching in further education – an outline of principles and practice, Bloomsbury Academic
Enkelmann N., Charyzma, Warszawa 2000;
Fenstermacher G., Soltis J., Style nauczania, Warszawa 2000
Gagne, R.M., Briggis, L.J., Wager, W.W. (1992). Zasady projektowania dydaktycznego.
Kwieciński Z., Śliwerski B. (red), Pedagogika. podręcznik akademicki 1 i 2, Warszawa 2003. PWN,
Mel, S. (2005) Uczymy się uczyć. Gdańsk:GWP
Mietzel, G. (2004). Psychologia kształcenia. Praktyczny podręcznik dla nauczycieli i pedagogów.
Morrison, K., Cohen, L. (1999). Wprowadzenie do nauczania. Poznań: wyd. Zysk i S-ka
Turner J., Helms D., Rozwój człowieka, Warszawa, 1999.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.III
Item Name	**General elective subjects block** **INFLUENCER MARKETING**
Course coordinator responsible for preparing the syllabus	dr Kinga Krupcała

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**15**	dr Kinga Krupcała

Lectures:
1. Online marketing – 2 hours
2. Influencer marketing – 2 hours

Project exercises:
1. Content marketing in relation to the presentation of scientific research – 2 hours
2. Scenery and the language of benefits, H2H – 3 hours
3. AIDA model – 3 hours
4. Sales matrices "re-framing", "Martin Luther King", "4P" – 3 hours

3. TEACHING METHODS

lecture (4 hours) - multimedia presentation combined with discussion, project exercises (11 hours) on writing texts on the web - preparation of a project from the exercises - running a channel on a selected social media platform (LinkedIn, FB, IG)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_c	Context – conditions, effects c) basic principles of commercialization and promotion of the results of scientific activity in contemporary media c) basic marketing methods for the promotion of scientific research
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge on promoting the results of scientific activity to solve problems in an innovative way or perform tasks in the economic environment with the use of influencer marketing methods
P8S_UW_c	Knowledge use – problems solved and tasks performed c) promote and transfer the results of scientific/research activities to the sphere of electronic economy and the social sphere

P8S_UK_b	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language b) promote the results of scientific activity, including in popular forms including social media
P8S_UK_c	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language c) initiate a debate on the results of research activities in the economic environment c) encourage the public to learn about new and interesting research results
P8S_UO_a	Work organization – planning and teamwork a) plan and implement individual and team research projects, taking into account the promotion of research results, a) prepare interesting and eye-catching texts promoting scientific activity
P8S_UU_a	Learning – planning your own development and the development of others a) independently plan and act for their own development and inspire and organize the development of others in the field of science marketing a) promote their own (or the team's) scientific activities in an interesting way (as it were, in a way of sales)
P8S_UU_b	Learning – planning your own development and the development of others b) plan classes or groups of classes and carry them out with the use of modern methods and tools in the field of science marketing
SOCIAL COMPETENCE: is ready to	
P8S_KO_c	Responsibility – fulfilling social obligations and acting for the public interest c) think and act in an entrepreneurial way in the field of science marketing
P8S_KR_a	Professional role – independence and ethos development a) promoting the results of scientific activity, maintaining and developing the ethos of research and creative communities, a) disseminate the latest scientific achievements in contemporary media in a way that interests the audience

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WK_c		x				
P8S_UW_a				x		
P8S_UW_c				x		
P8S_UK_b					x	
P8S_UK_c					x	
P8S_UO_a				x		
P8S_UU_a				x		
P8S_UU_b				x		
P8S_KO_c				x		
P8S_KR_a				x		

6. LITERATURE

Basic Literature
1. Cook M.J., Instagram Influencer Marketing Adversiting 2021, Wyd. Unlucky LTD, 2020 2. Glenister G., Influencer Marketing Strategy, Wyd. Kogan Page, 2021 3. Hennessy B., Influencer, Wyd. Dark Horse Comics,U.S., 2018 4. Jagiello M., Złote zasady marketingu online, Wyd. Artekaft, 2018 5. Stopczyńska K., Influencer marketing w dobie nowych mediów, Wyd. Uniwersytetu Łódzkiego, Łódź 2021
Additional Literature
1. Meerman S.D., Nowe zasady marketingu i PR, Wyd, Oficyna, 2009

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.IV
Item Name	**General elective subjects block** **SOFT SKILLS IN PRACTICE**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Witold Hołubowicz, prof. PBŚ

1. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**15**	dr hab. inż. Witold Hołubowicz, prof. PBŚ
The following issues are discussed:- negotiations- effective action - the job search process - oral and written communication		

2. TEACHING METHODS

Lecture – 15 hours

- Lecture with presentation
- Training videos
- Analysis of TED presentations related to the subject of the subject
- Negotiation training game
- Summary seminar

3. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_c	Context – conditions, effects c) basic principles of communication and transfer of knowledge to the economic and social sphere
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge and apply soft skills to creatively and effectively identify, formulate and innovatively solve complex problems or perform research tasks
P8S_UW_c	Knowledge use – problems solved and tasks performed c) transfer the results of scientific activity to the economic and social sphere using soft skills

P8S_UK_b	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language b) disseminate the results of scientific activity, also in popular forms using soft skills
P8S_UK_c	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language c) initiate debate, communicate and negotiate
P8S_UO_a	Work organization – planning and teamwork a) plan and implement individual and team creative projects, also in an international environment, using soft skills
P8S_UU_a	Learning – planning your own development and the development of others a) independently plan and act for their own development and inspire and organize the development of others, using soft skills
P8S_UU_b	Learning – planning your own development and the development of others b) plan classes or groups of classes and carry them out with the use of modern methods and tools, using soft skills
SOCIAL COMPETENCE: is ready to	
P8S_KO_c	Responsibility – fulfilling social obligations and acting for the public interest c) think and act in an entrepreneurial and effective manner
P8S_KR_a	Professional role – independence and ethos development maintaining and developing the ethos of research and creative environments, using soft skills

4. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WK_c			x			
P8S_UW_a					x	
P8S_UW_c			x			
P8S_UK_b					x	
P8S_UK_c					x	
P8S_UO_a					x	
P8S_UU_a					x	
P8S_UU_b					x	
P8S_KO_c					x	
P8S_KR_a					x	

5. LITERATURE

Basic Literature
1. E. Bonneau, „O zachowaniu się w pracy”, Warszawa 2000 2. S.Covey, „7 nawyków skutecznego działania”, Poznań 2003 3. M.C.Donaldson, M.Donaldson, „Negocjacje”, Warszawa 1999

Additional Literature
1. H-G. Schnitzer, „Poradnik współczesnego savoir-vivru”, Warszawa 1998 2. B.Lunden, L.Rosell, „Techniki negocjacji. Jak odnieść sukces w negocjacjach.wyd.3, Opole 2003

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.V
Item Name	**General elective subjects block** **OWN BUSINESS OR WORK IN A CORPORATION – WHICH IS BETTER?**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Witold Hołubowicz, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**15**	dr hab. inż. Witold Hołubowicz, prof. PBŚ
LECTURE: First contact with business. Assessment of whether you are suitable for business. Finding a niche in the market. Turn ideas into plans. The role of business model uniqueness. Organizational forms of your own company Finance: costs, liquidity and profitability. External financing. Avoiding failure in business. Business risk management. The operation of corporations and large institutions. SEMINARS: a case study of selected companies operating in Poland and abroad. Real-world examples of third-party funding applications. Are corporations toxic – discussion. A training game on business. Analysis of TED presentations related to the subject of the subject. Team Management Workshop		

3. TEACHING METHODS

Lecture (8 hours)
Seminars (7 hours)

- Lecture with presentation
- Training videos
- Analysis of TED presentations related to the subject of the subject
- Team Management Workshop
- Business Training Game

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the company and commercialization of the results of scientific activity in business
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed

	a) use knowledge about the company's activities to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the company
P8S_UW_c	Knowledge use – problems solved and tasks performed c) knowing the business specifics of the company, transfer the results of scientific activity to the economic and social sphere
P8S_UK_b	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language b) knowing the business specifics of the company, disseminate the results of scientific activity, also in popular forms
P8S_UK_c	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language c) initiate a debate with employees of cooperating companies
P8S_UO_a	Work organization – planning and teamwork a) plan and implement individual and team research or creative projects, also in the business environment
P8S_UU_a	Learning – planning your own development and the development of others a) independently plan and act for their own development and inspire and organize the development of others in the business environment
P8S_UU_b	Learning – planning your own development and the development of others b) plan classes or groups of classes for the company's employees and carry them out with the use of modern methods and tools
SOCIAL COMPETENCE: is ready to	
P8S_KO_c	Responsibility – fulfilling social obligations and acting for the public interest c) think and act in an entrepreneurial way in contacts with business
P8S_KR_a	Professional role – independence and ethos development maintaining and developing the ethos of research and creative communities in business environments

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	…
P8S_WK_c			x			
P8S_UW_a					x	
P8S_UW_c			x			
P8S_UK_b					x	
P8S_UK_c					x	
P8S_UO_a					x	
P8S_UU_a					x	
P8S_UU_b					x	
P8S_KO_c					x	
P8S_KR_a					x	

6. LITERATURE

Basic Literature
1. I. Bogaczyk, B. Krupski, H. Lubińska, "Własna firma. Zakładanie I prowadzenie działalności gospodarczej", Wyd. Forum 2011 2. G. Biesok, J. Wyród-Wróbel, "Człowiek w organizacji", Wyd CeDeWu 2019 3. I. Kamińska-Radomska, "Kultura biznesu", PWN 2011
Additional Literature
1. M. Urbanek, "99 dni pracy w korporacji", Wyd. EMKA, 2010 2. R. Kapuściński, „Cesarz", Wyd. Czytelnik, 2019

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.VI
Item Name	**General elective subjects block** **INVENTION TECHNIQUES**
Course coordinator responsible for preparing the syllabus	dr inż. Ilona Pyszka

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**15**	Ilona Pyszka, PhD Piotr Wojewódzki, Ph.D.
Innovation (concepts and types). Inventions and patents. Description of the invention. The title of the invention. Definition of the field of invention technology. Description of the invention technique. Determination of the disclosure of the invention. Beneficial effects of the invention. Explanation of the figures of the invention. An example of the implementation of an invention. Application of the invention. Patent claims. Summary of the description of the invention. A necessary drawing. Selected issues from the procedure of examining invention applications and assessing the patentability of an invention. Utility model and industrial design and trademark. Patent Information.		

3. TEACHING METHODS

A mixed form of classes. Part of the content is carried out in the form of lectures (8 hours), and part in the form of a seminar – discussion, presentation (7 hours).

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_c	Context – conditions, effects c) basic principles of creating and filing patent applications for an invention or utility model and implementing them into the economic sphere.
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge in the field of invention technology to creatively identify, formulate and innovatively create inventions and patents, and in particular: define the purpose and subject of a patent application, formulate the title of the invention, description of the invention technique and patent claims.
P8S_UW_c	Knowledge use – problems solved and tasks performed c) implement new or significantly improved product, process, marketing or organizational solutions into its business activity.
P8S_UK_b	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language b) disseminate the results of scientific activity in the form of filing a patent application.

P8S_UK_c	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language c) initiate discussion in the inventive environment.
P8S_UO_a	Work organization – planning and teamwork a) plan and implement individual and team research projects. To look for creative solutions to defined problems.
P8S_UU_a	Learning – planning your own development and the development of others a) independently plan and act for their own development. Develop the ability to think creatively and inspire and organize the development of others.
P8S_UU_b	Learning – planning your own development and the development of others b) plan classes or groups of classes and carry them out using modern innovative methods.
SOCIAL COMPETENCE: is ready to	
P8S_KO_c	Responsibility – fulfilling social obligations and acting for the public interest c) think and act in an innovative way.
P8S_KR_a	Professional role – independence and ethos development maintaining and developing the ethos of research and creative communities, including: conducting scientific activity in an independent manner, respecting industrial property rights, copyright and business secrets, taking into account the principles of intellectual property protection

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WK_c				X		
P8S_UW_a				X		
P8S_UW_c				X	X	
P8S_UK_b				X	X	
P8S_UK_c				X	X	
P8S_UO_a				X	X	
P8S_UU_a				X	X	
P8S_UU_b				X	X	
P8S_KO_c				X		
P8S_KR_a				X		

6. LITERATURE

Basic Literature
1. Red. Pyrża A, Warszawa 2017. Poradnik wynalazcy. Urząd Patentowy Rzeczpospolitej Polskiej. 2. Oprac. Sychowska H., Warszawa 2017. Teksty ujednolicone podstawowych aktów wykonawczych do ustawy Prawo własności przemysłowej. Urząd Patentowy Rzeczpospolitej Polskiej. 3. Oprac. Sychowska H., Warszawa 2016. Prawo własności przemysłowej. Ustawa z dnia 30 czerwca 2000 r. Urząd Patentowy Rzeczpospolitej Polskiej
Additional Literature

1. Bulletin of the Patent Office.
2. Patent Office News.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.VII
Item Name	**General subjects to choose from:** **SURFACE TESTING METHODS**
Course coordinator responsible for preparing the syllabus	dr inż. Marek Trzcinski

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**15**	Dr inż. Marek Trzciński
Surface structure, ideal and real surfaces. Straight and reverse surface network, surface defects. Preparation of atomically smooth surfaces. Diffractive methods for the study of surface structure (LEED / RHEED). Analysis of surface composition and chemical state using electron spectroscopy (ESCA/AES). High-resolution surface topography studies using scanning probe microscopy (SPM). Ionic surface testing and modification techniques (SIMS / FIM / FIB).		

3. TEACHING METHODS

Multimedia lecture 15 hrs

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_c	**Context – conditions, effects** c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in the field of surface research and phenomena
SKILLS: can	
P8S_UW_a	**Knowledge use – problems solved and tasks performed** a) use knowledge in the field of surface physicochemistry to creatively identify, formulate and innovatively solve complex problems or perform research tasks, draw conclusions based on the results of scientific research
SOCIAL COMPETENCE: is ready to	
P8S_KR_a	**Professional role - independence and ethos development** conducting scientific activity in an independent manner, respecting the principle of public ownership of the results of scientific activity

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	…
P8S_WK_c			×		×	
P8S_UW_a			×		×	
P8S_KR_a					×	

6. LITERATURE

Basic Literature
1. J.C. Vickerman, *Surface Analysis - The Principal Techniques*, John Wiley & Sons 2009 **2.** D. Briggs, M.P. Seah, *Practical Surface Analysis*, John Wiley & Sons 1990 **3.** A. Zangwill, *Physics at Surfaces*, Cambridge University Press 1988
Additional Literature
1. A. Oleś, *Metody doświadczalne fizyki ciała stałego*, WNT 1998 **2.** A. Szaynok, S. Kuźmiński, *Podstawy fizyki powierzchni półprzewodników*, WNT 2000 **3.** N. Yao, Z.L. Wang, *Handbook of Microscopy for Nanotechnology*, Kluwer Academic Publishers 2005

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.VII
Item Name	**General subjects to choose from: KNOWLEDGE MANAGEMENT IN SCIENCE AND BUSINESS**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Waldemar Bojar

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**15**	dr hab. inż. Waldemar Bojar

Lecture 1. Basic definitions and concepts of knowledge. Typology of knowledge.
Lecture 2. Models of knowledge management.
Lecture 3. Knowledge engineering. Tools, techniques, and methods in Decision Support Systems (DSS).
Lecture 4. Mathematical models in decision support systems. Predict outcomes using simulation experiments.
Lecture 5. Strategies for designing SWD.
Lecture 6. User interface – modern standards and requirements.
Lecture 7. Implementation and use of knowledge management systems in the enterprise.
Lecture 8. A knowledge management system supporting the technological preparation of production.
Lecture 9. Knowledge mapping in B+R organizations as an element of the innovation process (case studies).
Lecture 10. Artificial intelligence (AI) – classification and application of AI methods.
Lecture 11. Examples of tools used in decision support systems: elements of the SQL language, decision rules, decision tables, scenarios.
Lecture 12. Discovering knowledge from data (OLAP, OLTP, Data Mining).
Lecture 13. Definitions and applications of Business Intelligence and Big Data.
Lecture 14. Definition and construction of an expert system and applications.
Lecture 15. Knowledge management in the AGRICORE project, Horizon 2020'.

3. TEACHING METHODS

Multimedia and interactive lecture

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_c	After completing the course, the doctoral student knows and understands the definitions and essence of knowledge as well as knowledge management in the context of the principles of creating, transferring and using knowledge in the economic and social spheres.
SKILLS: can	

P8S_UW_a	After completing the subject, the doctoral student is able to use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems related to knowledge management.
P8S_UW_c	After completing the course, the doctoral student is able to extract knowledge from data with the help of the methods and tools learned in the field of critical analysis and evaluation of expert activity and other creative work in the context of solving problems in organizations with the help of the accumulated knowledge.
P8S_UK_b	After completing the subject, the doctoral student is able to disseminate the results of scientific activity, also in popular forms.
P8S_UK_c	After completing the subject, the doctoral student is able to initiate a debate on the issues of knowledge management.
P8S_UO_a	After completing the subject, the doctoral student is able to plan and implement individual and team research projects in the field of knowledge management.
P8S_UU_a	After completing the subject, the doctoral student is able to independently plan and act for their own development as well as inspire and organize the development of others.
P8S_UU_b	After completing the subject, the doctoral student is able to plan classes and implement them using modern methods and tools.
SOCIAL COMPETENCE: is ready to	
P8S_KO_c	After completing the subject, the doctoral student is ready to think and act in an entrepreneurial way.
P8S_KR_a	After completing the subject, the doctoral student takes a critical approach to the acquired and used knowledge, respecting the principles that build the ethos of research and creative environments, m.in. taking into account the principles of intellectual property protection.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WK_c					x	
P8S_UW_a				x	x	
P8S_UW_c				x	x	
P8S_UK_b					x	
P8S_UK_c					x	
P8S_UO_a					x	
P8S_UU_a					x	
P8S_UU_b					x	
P8S_KO_c					x	
P8S_KR_a					x	

6. LITERATURE

Basic Literature
Bojar W., Duda J. 2017. Systemy wspomagania decyzji. Zarządzanie wiedzą produkcyjną. 2017. [W:] Inżynieria produkcji. Kompendium wiedzy / red. Ryszard Knosala wydawniczy: Warszawa: Polskie Wydawnictwo Ekonomiczne, 2017. Kelm M. Mapowanie wiedzy w organizacjach B+R jako element procesu innowacyjnego. Śląska Wyższa Szkoła Zarządzania im. gen. J. Ziętka w Katowicach, Katedra Zarządzania, https://docplayer.pl/18259410-Mapowanie-wiedzy-w-organizacjach-b-r-jako-element-procesu-innowacyjnego.html, dostęp: 16. 05 2023. Patalas-Maliszewska J. 2013. Model zarządzania wiedzą w polskich przedsiębiorstwach produkcyjnych [W:] Monografia pod red. Katarzyny Rostek pt. „ Zarządzanie wiedzą w tworzeniu przewagi konkurencyjnej", Wydział Zarządzania Politechniki Warszawskiej, Warszawa, s. 189-198.
Additional Literature
Goh A.L.S. 2005. Harnessing knowledge for innovation: an integrated management framework , „Journal of Knowledge Management", vol. 9, nr 4, s. 6-18. Zarządzanie wiedzą. 2012. Trajer J., Paszek A., Iwan S. , PWE, Warszawa. Pod red. Z. Bubnickiego, A. Grzecha, 2003. Inżynieria wiedzy i systemy ekspertowe. T. 1. Oficyna Wydaw. Politechniki Wrocławskiej, Wrocław. Yakhlef A. 2005. Immobility of tacit knowledge and the displacement of the locus of innovation , European Journal of Innovation Management, vol. 8, nr 2, s. 227-239.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.VIII
Item Name	**General subjects to choose from:** **ANALYSIS OF MULTIDIMENSIONAL ANALYTICAL DATA**
Course coordinator responsible for preparing the syllabus	dr inż. Jan Lamkiewicz

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**15**	dr inż. Jan Lamkiewicz

1. Documentation of data and measurement results
2. Preparation of analytical data
3. Scripting languages that automate the process of analyzing analytical data
4. Chemometrics vs. Chemoinformatics
5. Methods of multivariate data analysis: principal component analysis (PCA), cluster analysis (CA) hierarchical cluster analysis (HCA), linear discriminant analysis (LDA), linear Fisher discriminant analysis (FDA), quadratic discriminant analysis (QDA), regulated discriminant analysis (RDA), k-nearest neighbor (k-NN) method, individual group modeling method (SIMCA), ANN - Artificial Neural Networks, support vector method (SVM), partial least squares method (PLS)
6. Practical use of selected methods in solving problems in the field of multidimensional analytical data analysis using the R project environment

3. TEACHING METHODS

Multimedia lecture with elements of data analysis based on open source programs
15 hrs

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) the scope of chemometric methods and computer-aided analysis of measurement results, which are used at an advanced level as tools for the analysis of multivariate data in natural sciences and engineering and technology.
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use scientific knowledge in the field of chemometrics, computer-aided and programming to analyze multidimensional analytical data obtained from scientific experiments
P8S_UW_b	Knowledge use – problems solved and tasks performed b) critically evaluate research data on the basis of the results of computer-aided data analysis
SOCIAL COMPETENCE: is ready to	

P8S_KK_c	Evaluations – a critical approach c) recognising the importance of scientific knowledge in the field of multivariate data analysis in solving analytical problems

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Project	
P8S_WG_c			X			
P8S_UW_a			X			
P8S_UW_b			X			
P8S_KK_c			X			

6. LITERATURE

Basic Literature

1. Mazerski J., Chemometria praktyczna - Interpretuj wyniki swoich pomiarów,2009, Wydawnictwo Malamut, ISBN: 978-83-925269-3-3
2. Zuba D., Parczewski A. (red.), 2008 Chemometria w analityce. Wybrane zagadnienia, ISBN 83-87425-13-3
3. Kurt Varmuza, Peter Filzmoser Introduction to Multivariate Statistical Analysis in Chemometrics, Taylor & Francis Inc; 2009
3. Autorskie materiały robocze do wykładów udostępniane na pierwszych zajęciach oraz dostępne online

Additional Literature

1. Adams M.J., 2004, Chemometrics in Analytical Spectroscopy, 2nd Edition
2. Geladi, P.; Esbensen, K., 2005, "The Start and Early History of Chemometrics: Selected Interviews. Part 1". J. Chemometrics 4 (5): 337–354, doi:10.1002/cem.1180040503.
3. Esbensen, K.; Geladi, P., 2005, "The Start and Early History of Chemometrics: Selected Interviews. Part 2". J. Chemometrics 4 (6): 389–412, doi:10.1002/cem.1180040604

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	11.VIII
Item Name	**General elective courses: CONDUCTING INNOVATIVE PROJECTS**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Bogdan Lent, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
V	**15**	dr hab. inż. Bogdan Lent, prof. PBŚ

The maximum number of people taking part in the classes is 12 people.
Classes are held in two blocks with a break of min. 4 weeks, during which students perform an individual analysis of their own Work&Life Balance and a practical project together in groups of 2-3 people.

Week One:

Classes are conducted in 3 blocks of 180 minutes a day (4 lesson hours)
The theoretical introduction (120 minutes) is immediately followed by project classes aimed at developing the ability to apply the acquired theoretical knowledge and critical self-reflection (60 minutes).

Block 1:

Project management as a cyber system

- Project features
- Cybernetics
- Project according to ISO21500:2021
- Project management processes
- I, II and III-order cybernetics in project management
- Corrective and adaptive feedback
- Self-reflection on one's own experiences

Intuition and emotions in running a project

- Leadership in research and innovation projects
- Dimensions of risk management decisions in projects
- Intelligent decisions
- Trends in the decision-making process of project management
- Cognition and decision-making in our brain
- Intuition and factors limiting the effectiveness of intuition
- Design and Reflections

Application of knowledge from block 2 in a selected project of students (Teams of 2-3 people)

- Intuitive evaluation of proposed project ideas

- Reflections on the impact of projects and their environment on the implementation of projects in the implementation of the proposed projects.

Block 2:

Defining the purpose of the research project and the innovation project

- What is a research project?
- What is an innovation project?
- Defining the purpose of the research project and the innovation project
- Demarcation for research purposes
- Rubicon model of project phases
- Tools and roles useful in an innovation project
- Work breakdown structure and project components
- Project organization
- Application of knowledge to selected team projects; Reflections

Managing administrative processes in project management

- Investments in research and innovation projects
- Project progress control
- Earned Value Analysis
- Milestone trend analysis
- Managing the process of solving problems and risks
- Change process management, integration, knowledge and documentation in the project
- Integral Project Evaluation (Balanced Score Card)
- Application of knowledge to selected team projects; Reflections

Application of knowledge from block 2 in a selected project of students (Teams of 2-3 people)

- Consolidate the description of the project goal and organization
- Development of rules for integration and cultivation of social capital in the project
- Preparation of content for development in relation to the team project.
- Consolidation of decisions to implement administrative processes in selected projects
- Developing a plan for the team's work in the period for presentation in the second week of classes

Block 3:

Management in collaboration projects, e.g. with other research centres

- What is a Collaboration project?
- Cooperation project: project or programme?
- Social capital as a success factor for a cooperation project
- Levels of relationships between participants in a cooperation project
- Cultural influences
- Lead a cooperation project
- Managing personal matters in a project
- Influence of personality, MBTI taxonomy
- Formal and informal roles
- The Tuckman Cycle
- Application of knowledge to selected team projects; Reflections

The Human Factor in Project Management - Conflict Resolution Management

- What is conflict?
- Potential and symptoms of conflicts

- Cooperative conflict resolution
- Principles of avoiding conflicts and seeking solutions
- Conflict prevention
- Crisis management.
- Application of knowledge to selected team projects; Reflections

The Human Factor in Project Management - Information and Marketing Management

- Cybernetics of communication
- Communication with stakeholders in the project (Stakeholder) and knowledge in collaborative projects
- Communication in information and marketing
- Basic rules of communication
- Project Communication Planning
- Transactional Analysis
- Preferred Personality Communication Techniques Myers-Briggs-Typenindikator MBTI
- The impact of informal roles on effective communication
- Non-verbal communication
- Special ways of communication for project leaders.
- Application of knowledge to selected team projects; Reflections

The human factor in project management - the development of one's own personality RWO

- Skills required in the labour market
- Happiness and satisfaction with life according to Santos (Yale) and IKIGAI
- The Relation Between Wealth and Happiness
- Preparation for individual work for the last block (week two)
    - Individual analysis of your own typical day.
    - Stress, SRRS scale, analysis of own determinants
    - Daily cycle
    - SWOT in-house analysis
    - Formulating Life Goals
    - Eisenhower and Pareto/ABC priorities
    - Managing your own time
    - Thieves of time

Application of knowledge from block 3 in a selected project of students (Teams of 2-3 people)

- Consolidation of strategies in team management and conflict resolution in selected projects
- Preparation of content for development in relation to the team project.

Period of development of the group project and preparation of the presentation:

Min. 4 weeks. Estimated workload of each student: approx. 20-30 hours in total.

Second week (min. 4 weeks after the first week of classes):

The classes include 1 block (3 lesson hours) of joint reflections on the analysis of one's own goal and time management, project presentations and reflections of the class participants.

Block 4:

Own conclusions, reflections and meta-cognition from practice in conducting innovative projects

- Reflections after analyzing your own goal and time management
- Presentation of the results of the work in the group projects
- Presentation of experiences and own conclusions, reflections and meta-cognition from the implementation of the selected phase of the project.
- Verification of the ability to apply and self-criticize the acquired knowledge
- Joint discussion of the participants.

3. TEACHING METHODS

Traditional methods used:
discussion and multimedia lecture, work with the system in the laboratory, project classes, discussion, case analysis method, project implementation, joint teamwork, development of reflections from observation, discussion, metacognition.

Distance learning methods used:

- Synchronous method in Teams of project implementation consultations
- Asynchronous method: Online educational videos, multimedia presentations played on-line.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: Knows and understands: P8S_WK: Context – conditions, effects	
P8S_WK_c	basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results
SKILLS: can P8S_UW: Leveraging knowledge – problems solved and tasks performed	
P8S_UW_a	use knowledge from various fields of science or the field of art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, and in particular: define the purpose and object of scientific research, formulate a research hypothesis, develop research methods, techniques and tools and creatively apply them, draw conclusions based on the results of scientific research.
P8S_UW_c	transfer the results of scientific activity to the economic and social sphere
SKILLS: can P8S_UK: Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language	

P8S_UK_b	disseminate the results of scientific activity, also in popular forms
P8S_UK_c	initiate debate
SKILLS: can P8S_UO: Work organization – planning and teamwork	
P8S_UO_a	plan and implement individual and team research or creative projects, also in an international environment
SKILLS: can P8S_UU: Learning – planning your own development and the development of others	
P8S_UU_a	independently plan and act for their own development and inspire and organize the development of others
P8S_UU_b	plan classes or groups of classes and carry them out using modern methods and tools
SOCIAL COMPETENCE: is ready to P8S_KO: Responsibility – fulfilling social obligations and acting for the public interest	
P8S_KO_c	thinking and acting in an entrepreneurial way
SOCIAL COMPETENCE: is ready to P8S_KR: Professional role – independence and ethos development	
P8S_KR_a	maintaining and developing the ethos of research and creative communities, including: conducting scientific activity in an independent manner, respecting the principle of public ownership of the results of scientific activity, taking into account the principles of intellectual property protection

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Execution of RWO tasks	Presentation	Discussion	Development of the project phase
P8S_WK_c				x	x	x
P8S_UW_a				x	x	x
P8S_UW_c				x	x	x
P8S_UK_b					x	
P8S_UK_c				x	x	
P8S_UO_a			x	x	x	x
P8S_UU_a			x	x	x	x
P8S_UU_b			x	x	x	x
P8S_KO_c			x	x	x	
P8S_KR_a			x	x	x	

6. LITERATURE

Basic Literature
1. Lent B, 2013, Cybernetic Approach to Project Management, Springer, 1-426 2. Rządowe Biuro Monitorowania Projektów (RBMP), 2021, Zarządzanie projektami strategicznymi: Rekomendacje, Kancelaria Prezesa Rady Ministrów (KPRM), 1-72 3. RBMP, 2021, Zarządzanie programami strategicznymi: Rekomendacje, KPRM, 1-64

4. RBMP, 2020, Przewodnik po zarządzaniu. Praktyczne wskazówki dla zarządzających programami i projektami, KPRM, 1-205
5. ISO, 2021, ISO 21500:2021, Project, programme and portfolio management — Context and concepts, 1-12
6. Lent B. 2005, Zarządzanie procesami prowadzenia projektów. Informatyka i Telekomunikacja, Difin, 1-420

Additional Literature

1. Leybourne A, Sadler-Smith E, 2006, The role of intuition and improvisation in project management, Intl. Journal of Project Management, V24, Issue 6, August 2006, 483-492
2. Marquardt K, 2009, Vom Umgang mit Komplexität in Projekten, www.kmarquardt.de
3. Turner JR, Anbari F, Bredillet Chr, 2013, Perspectives on Research in Project Management: The Nine Schools , Glob Bus Perspect (2013), 1: 3-28
4. Hofstede G, Minkov M, 2015, Cross-Cultural Research, Sage Publications, Vol. 48(2), 144-176

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ich.I
Item Name	**A block of subjects from the discipline *of chemical engineering* to choose from:** **MEMBRANE BIOREACTORS**
Course coordinator responsible for preparing the syllabus	dr inż. Wirginia Tomczak

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**15***	dr inż. Wirginia Tomczak

*- subject taught separately in a group of disciplines

Lecture 1. Membranes - structure, classification, characteristics and methods of obtaining
Lecture 2. Advantages of membrane processes
Lecture 3. Pressure membrane processes - Principles of operation and examples of applications
Lecture 4. Principle of operation and advantages of membrane bioreactors
Lecture 5. Membrane Blocking in Membrane Bioreactors
Lecture 6. Application examples of membrane bioreactors
Lecture 7. Influence of Process Parameters on the Performance of Membrane Bioreactors

3. TEACHING METHODS

multimedia lecture, discussion
(15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies: a) to the extent that allows for the revision of existing paradigms, the world achievements, including theoretical foundations and general issues and selected specific issues – specific to a given scientific or artistic discipline
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies: b) the main development trends of the scientific or artistic disciplines in which education takes place,
SKILLS: can	
P8S_UK_a	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language: a) communicate on specialist topics to the extent that allows active participation in the international scientific community
P8S_UW_b	Use of knowledge – problems solved and tasks performed: b) critically analyse and evaluate the results of scientific research, expert activity and other creative work and their contribution to the development of knowledge

SOCIAL COMPETENCE: is ready to	
P8S_KK_c	Assessments – a critical approach: c) recognising the importance of knowledge in solving cognitive and practical problems

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Project	…
P8S_WG_a			X			
P8S_WG_b			X			
P8S_UK_a			X			
P8S_UW_b			X			
P8S_KK_c				X		

6. LITERATURE

Basic Literature

1. Ratajczak P., 2013. Procesy membranowe – wprowadzenie. Tech. Wod. 4, 16–20.
2. Tomczak W., Gryta M., 2022. Energy-efficient AnMBRs technology for treatment of wastewaters: A review. Energies, 15(14), 4981. DOI: 10.3390/en15144981
3. Praca zbiorowa pod red. A. Narębskiej, Membrany i membranowe techniki rozdziału, UMK, Toruń, 1997.

Additional Literature

1. Tomczak W., Gryta M., Grubecki I., Miłek J., 2023. Biogas production in AnMBRs via treatment of municipal and domestic wastewater: Opportunities and fouling mitigation strategies. Applied Sciences 13(11), 6466. DOI: 10.3390/app13116466

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ich.II
Item Name	**A block of subjects from the discipline *of chemical engineering* to choose from:** **BIOCHEMICAL ENGINEERING IN SUSTAINABLE DEVELOPMENT TECHNOLOGIES**
Course coordinator responsible for preparing the syllabus	dr inż. Justyna Miłek

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**15***	dr inż. Justyna Miłek

*- subject taught separately in a group of disciplines

Influence of hydrodynamic conditions on living cells. Methods of conducting biotechnological processes – bioreactors, photobioreactors. Basic techniques for the separation of bio-based products. Industrial production of biodiesel. Production of biopharmaceuticals. Production of biofuels from biomass.

3. TEACHING METHODS

multimedia lecture, demonstration, discussion, case method
(15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	to the extent that allows for the revision of existing paradigms – a global achievement, including theoretical foundations as well as general issues and selected specific issues – specific to chemical engineering
P8S_WG_b	Main development trends in the discipline of chemical engineering
SKILLS: can	
P8S_UW_b	critically analyse and evaluate the results of scientific research, expert activity and other creative work and their contribution to the development of knowledge
P8S_UK_a	communicate on specialist topics to the extent that allows active participation in the international scientific community
P8S_UU_a	independently plan and act for their own development and inspire and organize the development of others
SOCIAL COMPETENCE: is ready to	
P8S_KK_c	recognition of the importance of knowledge in solving cognitive and practical problems

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Project	…
P8S_WG_a				X		
P8S_WG_b			X			
P8S_UW_b				X		
P8S_UK_a			X	X		
P8S_UU_a			X			
P8S_KK_c			X	X		

6. LITERATURE

Basic Literature
1. C. Larroche, M. Á. Sanromán, G. Du, A. Pandey (red.) Current developments in biotechnology and bioengineering bioprocesses, bioreactors and controls, Elsevier Science Academic Press, 2017 (e-book). 2. M. Jerold and V. Sivasubramanian (red.) Biochemical and environmental bioprocessing challenges and developments, CRC Press, 2020 (e-book).
Additional Literature
1. R. Pogaku, A. Bono, C. Chu (red.) Developments in sustainable chemical and bioprocess technology, Springer Science+Business Media, New York, 2013 (e-book).

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ich.III
Item Name	**A block of subjects from the discipline *of chemical engineering* to choose from:** **OPTIMIZATION OF CHEMICAL ENGINEERING PROCESSES**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Ireneusz Grubecki, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**30***	dr hab. inż. Ireneusz Grubecki, prof. PBŚ

*- subject taught separately in a group of disciplines

The concept of an optimization task. Mathematical programming. Introduction to dynamic programming. Basics of variational optimization methods: a) Pontriagin's maximum principle, b) the classical method of variational calculus. Application of optimization theory in basic chemical engineering processes.

3. TEACHING METHODS

Multimedia lecture, discussion (15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_c	research methodology
SKILLS: can	
P8S_UW_a	use knowledge from various fields of science or the field of art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, and in particular: define the purpose and object of scientific research, formulate a research hypothesis, develop research methods, techniques and tools and creatively apply them, draw conclusions based on the results of scientific research
P8S_UW_b	critically analyse and evaluate the results of scientific research, expert activity and other creative work and their contribution to the development of knowledge
SOCIAL COMPETENCE: is ready to	
P8S_KK_c	recognition of the importance of knowledge in solving cognitive and practical problems

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Project	…
P8S_WG_c			×	×		
P8S_UW_a			×	×		
P8S_UW_b			×	×		
P8S_KK_c			×	×		

6. LITERATURE

Basic Literature
1. S. Sieniutycz, Optymalizacja w inżynierii procesowej, Wydawnictwa Naukowo-Techniczne, Warszawa, 1991. 2. R. Krupiczka, Optymalizacja procesowa, Wydawnictwo Politechniki Śląskiej, Gliwice, 1998.
Additional Literature
1. T. F. Edgar, D. M. Himmelblau, L. Lasdon, Optimization of chemical processes, McGraw-Hill, New York, 2001.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ich.IV
Item Name	**A block of subjects from the discipline *of chemical engineering* to choose from:** **SELECTED ASPECTS OF THE PRACTICAL APPLICATION OF CHEMICAL ENGINEERING**
Course coordinator responsible for preparing the syllabus	dr inż. Sławomir Żak

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**15***	dr inż. Sławomir Żak

*- subject taught separately in a group of disciplines

Elements of design and practical conduct of selected operations and unit processes in the chemical industry. Phase transitions in energy balances – examples of industrial applications and calculation rules. Heat Pipe Heat Exchangers – Basics of Calculation and Design as well as Areas of Application in the Chemical Industry. Selected aspects of material balances and economics of chemical processes for full-scale industrial conditions. Liquid flow and material conditions of transport pipelines and fittings – on selected industrial examples with calculations. Filtration on an industrial scale and the basis of pressure calculations of chamber presses.

3. TEACHING METHODS

multimedia lecture, demonstration, discussion, lecture, case method
(15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WK_c	c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results
SKILLS: can	
P8S_UW_a	a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks, and in particular: define the purpose and object of scientific research, formulate a research hypothesis, develop research methods, techniques and tools and creatively apply them, draw conclusions based on the results of scientific research
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	a) critical evaluation of achievements within the scientific discipline of chemical engineering,

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Project	…
P8S_WK_c				x		
P8S_UW_a				x		
P8S_KK_a				x		

6. LITERATURE

Basic Literature
1. Praca zbiorowa pod redakcją Synoradzki L., Wisialski J., 2019, Projektowanie procesów technologicznych. Od laboratorium do instalacji przemysłowej. Oficyna Wydawnicza Politechniki Warszawskiej, 258. 2. Praca zbiorowa pod redakcją Synoradzkiego L., Wisialskigo J., 2012, Projektowanie procesów technologicznych. Bezpieczeństwo procesów chemicznych. Oficyna Wydawnicza Politechniki Warszawskiej, 214. 3. Gadomska-Gajadhur A., Jańczewski D., Różycki C., Synoradzki L., 2020, Projektowanie procesów technologicznych. Matematyczne metody planowania eksperymentów. Oficyna Wydawnicza Politechniki Warszawskiej, 244.
Additional Literature
1. Kucharski S., Głowiński J., 2010, Podstawy obliczeń projektowych w technologii chemicznej, Oficyna Wydawnicza Politechniki Wrocławskiej, 318. 2. Dylewski R., 1999, Projekt technologiczny: rodzaje opracowań badawczych i badawczo-projektowych, przykłady, materiały pomocnicze, Wydawnictwo Politechniki Śląskiej, 112. 3. Jańczewski D., Różycki C., Synoradzki L., 2010, Projektowanie procesów technologicznych. Część II. Matematyczne metody planowania eksperymentów, Oficyna Wydawnicza Politechniki Warszawskiej, 244.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ich.IX
Item Name	**A block of subjects from the discipline *of chemical engineering* to choose from:** **MODERN METHODS OF METAL REMOVAL IN INDUSTRY AND THE ENVIRONMENT**
Course coordinator responsible for preparing the syllabus	dr inż. Katarzyna Witt

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**15***	dr inż. Katarzyna Witt

*- subject taught separately in a group of disciplines

Specificity of metals. Non-anthropogenic and anthropogenic sources of metals. Metal removal methods used in the natural and industrial environment. Permeable reactive barriers. Metal sorption on various natural and synthetic materials (microorganisms, plants, shells, zero-valent iron, activated carbons, peat, zeolites, fly ashes, etc.). Precipitation methods. Membrane methods (nano-, ultra-, microfiltration, reverse osmosis, absorption membranes, polymer inclusion membranes).

3. TEACHING METHODS

multimedia lecture, discussion
(15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	to the extent that it allows you to learn about the world's achievements, including theoretical foundations and general issues and selected specific issues related to the issues of metal removal
P8S_WG_b	Main development trends in scientific disciplines related to metal removal
P8S_WG_c	methodology of scientific research in the field of metal removal methods
P8S_WK_c	basic principles of knowledge transfer to the economic and social sphere and commercialization of scientific research results and know-how related to these results
SKILLS: can	
P8S_UW_a	use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks, and in particular: define the purpose and object of scientific research, formulate a research hypothesis, develop research methods, techniques and tools and creatively apply them, draw conclusions based on the results of scientific research
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	critical evaluation of achievements within the discipline of chemical engineering

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Project	…
P8S_WG_a			X			
P8S_WG_b			X			
P8S_WG_c			X			
P8S_WK_c			X			
P8S_UW_a			X			
P8S_KK_a			X			

6. LITERATURE

Basic Literature
1. Karwowska E. 2007. Mikrobiologiczne procesy usuwania metali ze ścieków i szlamów galwanizerskich. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa. 2. Gąsiorek J. 2010. Dwustopniowe biologiczne usuwanie metali ciężkich z osadów ściekowych na przykładzie nadmiernego osadu czynnego. Wydawnictwo Politechniki Poznańskiej, Poznań. 3. Kuczajowska-Zadrożna M. 2016. Usuwanie metali ciężkich przez biosorbenty. Wydawnictwo Uniwersytetu Warminsko-Mazurskiego, Olsztyn.
Additional Literature
1. Sastre A.M., Pabby A.K., Rizvi S.S.H. 2008. Handbook of Membrane Separations. CRC Press

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ich.V
Item Name	**A block of subjects from the discipline *of chemical engineering* to choose from:** **MODERN METHODS OF TESTING POLYMER MATERIALS**
Course coordinator responsible for preparing the syllabus	dr inż. Krzysztof Lewandowski dr inż. Katarzyna Skórczewska

3. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr inż. Krzysztof Lewandowski dr inż. Katarzyna Skórczewska

*- subject taught separately in a group of disciplines

Influence of chemical structure on selected functional and processing properties of polymer plastics. The concept of polymer plastics. Identification test methods – quantitative and qualitative analysis of polymers. Modern methods of structural analysis of plastics. Principles for the determination of mechanical, thermal and processing properties of polymer plastics. Standardization of tests. Advanced and modern measurement techniques. Design and implementation of a research program in terms of solving practical and scientific problems related to polymer plastics.

4. TEACHING METHODS

Multimedia lecture, discussion
(15 hours)

5. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – global achievements, including theoretical foundations and general issues and selected specific issues in the field of chemical engineering related to polymer materials
P8S_WG_c	Context – conditions, effects c) research methodology with particular emphasis on polymer materials
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science and chemical engineering to creatively identify, formulate and innovatively solve complex problems or perform research tasks, and in particular: define the purpose and object of scientific

	research, formulate a research hypothesis, develop research methods, techniques and tools and creatively apply them, draw conclusions based on the results of scientific research
P8S_UW_b	Knowledge use – problems solved and tasks performed b) critically analyse and evaluate the results of scientific research, expert activity and other creative work and their contribution to the development of knowledge in the field of chemical engineering
P8S_UO_a	Work organization – planning and teamwork a) plan and implement individual and team research projects
SOCIAL COMPETENCE: is ready to	
P8S_KK_c	Evaluations – a critical approach c) recognizing the importance of knowledge in solving cognitive and practical problems in the field of chemical engineering,
P8S_KR	Professional role – independence and ethos development maintaining and developing the ethos of research and creative communities, including: conducting scientific activity in an independent manner, respecting the principle of public ownership of the results of scientific activity, taking into account the principles of intellectual property protection

6. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x		x	
P8S_WG_c			x		x	
P8S_WK_c			x		x	
P8S_UW_a			x		x	
P8S_UW_b			x		x	
P8S_UO_a			x		x	
P8S_KK_c			x		x	
P8S_KR			x		x	

7. LITERATURE

Basic Literature

1. Broniewski T., Kapko J., Płaczek W., Thomalla J.: Metody badań i ocena właściwości tworzyw sztucznych, WNT, Warszawa 2000
2. Grellmann W. (red), Seidler S. (red.): Polymer Testing, Hanser Publications; Monachium 2007
3. Brown R. (red.): Handbook of Polymer Testing - Short-Term Mechanical Tests, Rapra Technology Limited, Shawbury 2002
4. Normy europejskie i polskie: EN ISO 527, EN ISO 1133, EN ISO 179, EN ISO 306

Additional Literature

1. Karasiewicz T., Moraczewski K., Rytlewski P., Stepczyńska M., Żenkiewicz M.: Metody badań i oceny niektórych właściwości tworzyw polimerowych i metali, Wydawnictwo UKW, Bydgoszcz 2012
2. Przygocki W.: Metody fizyczne badań polimerów, PWN, Warszawa 1990
3. scopus.com

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ich.VI
Item Name	**A block of subjects from the discipline *of chemical engineering* to choose from:** **MODERN TECHNIQUES OF PLASTICS PROCESSING**
Course coordinator responsible for preparing the syllabus	dr inż. Krzysztof Lewandowski dr inż. Katarzyna Skórczewska

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**15***	dr inż. Krzysztof Lewandowski

*- subject taught separately in a group of disciplines

Properties of polymers in the plasticized state. Characteristics of processing methods for thermoplastics – extrusion, injection, rolling, rotational casting and others. Current directions of development of injection and extrusion process technology. Selected issues in the production of complex polymer materials using various processing techniques. Modern design solutions for machines and tools designed for the processing of polymer plastics. Issues in the field of modern techniques and lines for recycling polymer plastics.

3. TEACHING METHODS

Multimedia lecture, discussion
(15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent enabling the revision of existing paradigms – global achievements, including theoretical foundations and contemporary general issues and selected specific issues specific to chemical engineering, in particular in the field of modern techniques of polymer plastics processing, their importance and prospects for development,
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) main development trends in the discipline of chemical engineering, in particular prospects for the development of polymer plastics processing techniques,
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the field of chemical engineering, especially the design of modern techniques for processing polymer plastics
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach

	a) critical evaluation of achievements in chemical engineering

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Project	Discussion
P8S_WG_a			X			X
P8S_WG_b			X			X
P8S_UW_a			X			X
P8S_KK_a			X			X

6. LITERATURE

Basic Literature
1.Wilczyński K. (red.), 2019, Przetwórstwo tworzyw polimerowych, Oficyna Wydawnicza Politechniki Warszawskiej. 2. Sikora R., 1993, Przetwórstwo tworzyw wielkocząsteczkowych, Żak Wydawnictwo Edukacyjne Zofii Dobkowskiej. 3. Pearson J. R. A., 1985, Mechanics of polymer processing, Elsevier Applied Science Publishers
Additional Literature
1. Sikora R. (red), 2006, Przetwórstwo tworzyw polimerowych : podstawy logiczne, formalne i terminologiczne, Wydawnictwo Uczelniane Politechniki Lubelskiej. 2. Bociąga E.. 2008, Specjalne metody wtryskiwania tworzyw sztucznych, WNT

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ich.VII
Item Name	**A block of subjects from the discipline *of chemical engineering* to choose from:** **MODERN ANTI-CORROSION TECHNOLOGIES**
Course coordinator responsible for preparing the syllabus	dr inż. Joanna Kowalik dr inż. Anna Zalewska

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**15***	dr inż. Joanna Kowalik dr inż. Anna Zalewska

*- subject taught separately in a group of disciplines

Applicable standards in the field of PN-EN ISO 12944. Corrosion protection of steel structures with protective paint systems. Interpretation of requirements and principles of selection of anti-corrosion paint protection – examples of painting systems. Types of anti-corrosion products and their application. New trends and technologies in the execution of corrosion protection. Quality control of paint coatings - accelerated and physico-mechanical tests.

3. TEACHING METHODS

lecture with multimedia presentation, discussion
(15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies (a) to the extent that it is possible to revise existing paradigms, global achievements, including theoretical foundations and issues general and selected specific issues specific to chemical engineering
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) main development trends in the discipline of chemical engineering
P8S_WG_c	Context – conditions, effects c) methodology of scientific research in chemical engineering
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the field of chemical engineering
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements in chemical engineering

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Project	Discussion
P8S_WG_a			X			X
P8S_WG_b			X			X
P8S_WG_c			X			X
P8S_UW_a			X			X
P8S_KK_a			X			X

6. LITERATURE

Basic Literature

1. Zenowicz Z., Gauda K., Powłoki organiczne w technice antykorozyjnej, Politechnika Lubelska, 2003.
2. Moller P. Nielsen L.P., Advanced Surface Technology, 2013 National Assocition for Surface Finishing, Moller and Nielsen, Volume 01, 02
3. Wójtowicz M., Piwowarczyk W., Zasady diagnostyki zabezpieczeń antykorozyjnych stalowych konstrukcji budowlanych, Instytut Techniki Budowlanej, 2008.
4. Wójtowicz M., Zabezpieczenia przed korozją stalowych konstrukcji budowlanych za pomocą powłok malarskich, Instytut Techniki Budowlanej, 2010.

Additional Literature

1. Normy: Farby i lakiery
2. Czasopismo Lakiernictwo, www.lakiernictwo.net
3. Publikacje z naukowych baz danych: Science Direct, Scopus, Web of Science

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ich.VIII
Item Name	**A block of subjects from the discipline *of chemical engineering* to choose from:** **NEW POLLUTANTS AND THEIR ENVIRONMENTAL EFFECTS**
Course coordinator responsible for preparing the syllabus	dr inż. Alicja Gackowska dr inż. Waldemar Studziński

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

Semester	hours	Host
VI	**15***	dr inż. Alicja Gackowska dr inż. Waldemar Studziński

*- subject taught separately in a group of disciplines

1. Classification, potential sources and risks of emerging pollutants.
2. Emerging pollutants in the aquatic environment: occurrence, monitoring, fate and risk assessment.
3. Pharmaceutical residues in the environment – methods of identification, advanced disposal methods, ecotoxicological assessment of pharmaceutical residues and their transformation products.
4. Monitoring of microplastics in environmental matrices. Innovative methods for the degradation of microplastics in the aquatic environment.
5. Microplastics as Emerging Food Contaminants: A Food Safety Challenge.
6. Evaluation of environmental properties and toxicity of UV filters.
7. Residues of plant protection products. Monitoring of food products. Rules for the safe use of pesticides.

3. TEACHING METHODS

multimedia lecture, discussion (15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms, the world achievements, including theoretical foundations and general issues and selected specific issues – specific to a given scientific or artistic discipline
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) the main development trends of the scientific or artistic disciplines in which education takes place, i.e. related to the identification of new environmental pollutants and the assessment of the impact of pollution on individual elements of the environment
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies (c) the methodology of scientific research in the field of environmental sampling and analysis and the evaluation of ecotoxicology

P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, and in particular: define the purpose and object of scientific research, formulate a research hypothesis, develop research methods, techniques and tools and creatively apply them, draw conclusions based on the results of scientific research
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements within a given scientific or artistic discipline

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Project	Discussion
P8S_WG_a			x			
P8S_WG_b				x		
P8S_WG_c				x		
P8S_WK_c						x
P8S_UW_a				x		
P8S_KK_a						x

6. LITERATURE

Basic Literature

1. Dudziak, M., 2018, Substancje aktywne biologicznie w środowisku człowieka : wybrane problemy, Gliwice : Wydawnictwo Politechniki Śląskiej, 2018.
2. Kapelewska, J., 2020, Związki endokrynnie czynne w środowisku wodnym - analityka i wpływ na organizmy żywe, Warszawa : Wydawnictwo Naukowe PWN, 2020, Strony 661-674
3. Wszołek, T., 2018, Ochrona środowiska dla inżynierów, Warszawa : Wydawnictwo Naukowe

Additional Literature

1. Meller, E., 2021, Aktualne problemy naukowo-badawcze w inżynierii środowiska : praca zbiorowa, Szczecin : Wydawnictwo Uczelniane Zachodniopomorskiego Uniwersytetu Technologicznego, 2021.
2. Wąsowski, J., 2020, Mikroplastiki w środowisku wodnym, Warszawa : Wydawnictwo Naukowe PWN SA

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ilgit.I
Item Name	**A block of subjects from the discipline of *civil engineering, geodesy and transport* to choose from: PROTECTING BUILDING PARTITIONS FROM ENVIRONMENTAL IMPACTS**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Maria Wesołowska, profesor PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. inż. Maria Wesołowska, profesor PBŚ

Physical phenomena affecting the durability of building materials – examples of experimental research and modeling.
Chemical processes affecting the durability of building materials. Internal and external factors that trigger chemical corrosion. Impact of soluble mineral salts on selected materials and material systems, the phenomenon of efflorescence and subflorescence – examples of experimental research.
The role of mortar in shaping the integrity and thermal properties of masonry – examples of experimental research and modelling.
Susceptibility of material systems of building partitions and their details to internal and external environmental factors. Identification of biotic and abiotic factors.
The phenomenon of driving rain and the state of thermal and moisture protection of walls.
Protection of historic buildings: repair works and improvement of the state of thermal protection.
Selected methods and research devices monitoring the condition of building partitions and built-in materials.

3. TEACHING METHODS

Lecture - 7 hours, seminar - 8 hours

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies The doctoral student has in-depth knowledge related to the global scientific achievements including theoretical foundations as well as general issues and selected specific issues in the field of building physics and physics of building materials.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies

	b) main development trends in the discipline of civil engineering, geodesy and transport
P8S_WG_c	Context – conditions, effects The PhD student is familiar with the latest achievements in the field of modelling and experimental research of thermal and humidity phenomena in building partitions
P8S_WK_c	Context – conditions, effects A doctoral student knows the basic principles of knowledge transfer to the economic sphere in the discipline of civil engineering, geodesy and transport.
SKILLS: can	
P8S_UW_a	A PhD student is able to propose methods, techniques and research tools to solve a research problem related to the issues of building physics in relation to the existing state of knowledge.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	A PhD student is ready to conduct research in an independent manner while maintaining ethical and legal standards in research work. Understands the responsibility for the proposed solutions and formulated opinions on thermal and humidity issues in building partitions.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a				x		
P8S_WG_b				x		
P8S_WG_c				x		
P8S_WK_c				x		
P8S_UW_a				x	x	
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Wesołowska M.: Ochrona murów licowych przed wpływem środowiska, Uniwersytet Technologiczno-Przyrodniczy w Bydgoszczy, Bydgoszcz 2016.
2. Wesołowska M., Szczepaniak P., Pawłowski K., Kaczmarek A.Zagadnienia fizykalne w termomodernizacji i remontach obiektów budowlanych, Wydawnictwa Uczelniane Uniwersytetu Technologiczno-Przyrodniczego 2020.

Additional Literature

1. Garbalińska H., Gawin D., Nowak H.: Fizyka budowli w Polsce: ośrodki naukowe, ich potencjał i osiągnięcia. Wydawnictwo Politechniki Łódzkiej 2021.
2. Wójcik R.: Docieplanie budynków od wewnątrz. Grupa Medium 2018.

3. Tokarski D. Ickiewicz I. : Naprawy zabytkowych murów warstwami uzupełniającymi z dodatkiem biowęgla, oficyna wydawnicza Politechniki Białostockiej 2021.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ilgit.II
Item Name	**A block of subjects from the discipline of *civil engineering, geodesy and transport* to choose from: MANAGING CONSTRUCTION PROJECTS FROM A SUSTAINABLE PERSPECTIVE**
Course coordinator responsible for preparing the syllabus	dr inż. Jarosław Górecki

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr inż. Jarosław Górecki

Prospects for managing an investment and construction project: scope, time, cost and quality. Stakeholders of investment and construction projects. Work Breakdown Structure (WBS). Optimization of technological and organizational solutions. Risk analysis of construction projects. Risk factors in individual phases of a construction project. Reliability of construction production lines. Optimization of construction schedules. Intelligent investment and construction project management systems. Operational management in the management of investment and construction projects. Simulations of the course of construction projects. The roles of the individual stakeholders in the project. BIM in the service of building information management. Global economy and sustainable development. Reducing the negative impact on the environment, including reducing CO2 emissions. Circular Economy. Legal basis for sustainable development in construction. Assessment of the impact of a building on the environment. LEED. BREEAM. The concept of embodied energy in the cycle of a building object. Analysis of economic indicators and sustainable development in construction. Environmentally friendly technologies and materials used, as well as design in construction according to the principles of sustainable development and circular economy. Examples of integrated architectural and construction design taking into account economic, ecological and social aspects. Lean management in construction.

3. TEACHING METHODS

lecture
lecture – 15 hours

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent enabling the revision of the existing paradigms – global achievements, including theoretical foundations and general issues and

	selected specific issues for the discipline of civil engineering, geodesy and transport, and in particular technical, economic and environmental conditions for the implementation of construction works,
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) main development trends for the discipline of civil engineering, geodesy and transport, in particular in the field of technical, economic and environmental conditions for the implementation of buildings
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) methodology of scientific research for the discipline of civil engineering, geodesy and transport, taking into account technical, economic and environmental aspects of the implementation of construction facilities
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results for the discipline of civil engineering, geodesy and transport, and in particular in the field of technical, economic and environmental conditions for the implementation of construction facilities
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed b) use knowledge from the discipline of civil engineering, geodesy and transport and other related disciplines (including: materials engineering and environmental engineering, mining and energy), as well as other fields (Journal of Social Sciences) to creatively identify, formulate and innovatively solve complex problems or perform research tasks in relation to the technical, economic and environmental conditions for the implementation of construction facilities
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements within the discipline of civil engineering, geodesy and transport, and in particular collaboration with other researchers in the field of technical, economic and environmental conditions for the implementation of buildings

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c			x			
P8S_WK_c			x			
P8S_UW_a					x	
P8S_KK_a					x	

6. LITERATURE

Basic Literature
1. Bizon-Górecka J., Determinanty sukcesu przedsiębiorstw budowlanych zaangażowanych w realizację projektów w międzynarodowej kooperacji, TNOiK, Bydgoszcz 2011. 2. Bizon-Górecka J., Modelowanie struktury systemu zarządzania ryzykiem w przedsiębiorstwie – ujęcie holistyczne, TNOiK, Bydgoszcz 2007. 3. Hegazy T., Computer-Based Construction Project Management (ebook), Pearson 2013. 4. Jaworski K. M., Metodologia projektowania realizacji budowy, PWN, Warszawa 1999. 5. Kibert Ch. J., Sustainable Construction: Green Building Design and Delivery. John Wiley & Sons 2012. 6. Pawlak M., Zarządzanie projektami, Wydawnictwo Naukowe PWN, Warszawa 2007. 7. Risk Management Treatise for Engineering Practitioners, Ed. Chike Oduoza, IntechOpen, London, 2018. 8. Rubrich L., An Introduction to Lean Construction: Applying Lean to Construction Organizations and Processes. WCM Associates LLC 2012.
Additional Literature
1. Bizon-Górecka J., Inżynieria niezawodności i ryzyka w zarządzaniu przedsiębiorstwem. OPO, Bydgoszcz 2001. 2. Dholakia R., Wackernagel M., Ecological Footprint Accounts: Moving Sustainability [w:] Concept to Measurable Goal. Oakland: Redefining Progress 1999. 3. Mamlouk M. S., Zaniewski J. P., Materials for Civil and Construction Engineers (ebook), Pearson 2017. 4. Wideman R. M. First Principles of Project Management. AEW Services, Vancouver, BC Corporation 2000. 5. Międzynarodowe bazy książek i czasopism (np. Scopus, Web of Science). 6. PN-EN ISO 14001:2015-09 - wersja polska. Systemy zarządzania środowiskowego – Wymagania i wytyczne stosowania. 7. PN-EN ISO 14040:2009 - wersja polska. Zarządzanie środowiskowe – Ocena cyklu życia – Zasady i struktura.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ilgit.III
Item Name	**A block of subjects from the discipline of *civil engineering, geodesy and transport* to choose from: DURABILITY OF BUILDING STRUCTURES**
Course coordinator responsible for preparing the syllabus	dr inż. Justyna Sobczak-Piąstka

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr inż. Justyna Sobczak-Piąstka

Lecture:
Shaping the basic structural elements of buildings, assessment of their function. Limit states of the structure, and the durability and reliability of this structure. Identification of environmental factors causing a decrease in the durability of the building structure. Designing building structures in terms of durability, taking into account the resistance of the structure to environmental factors causing degradation throughout the life of the building (primarily during the period of use of the structure). General requirements for the execution, acceptance and inspection of construction works. Rules for performing periodic inspections of buildings. Object Book. Rules for maintaining buildings.
Basic issues in the field of diagnostics of the technical condition of buildings and the causes of damage to these structures. Basic methods (destructive and non-destructive) of assessing the technical condition and the principles of determining the wear and tear of buildings. Damage classification.
Methods of repairing, strengthening and renovating elements of reinforced concrete, steel and wooden structures. Materials and technologies used Method of preparing the test report and repair documentation.
Exercises:
An element of the building should be designed during the durability period under the given environmental impacts. The principles and requirements of the Eurocodes shall be fully applied in the design.

3. TEACHING METHODS

lecture (8 hours) lecture classes (7 hours)

a lecture carried out with the use of multimedia techniques or a lecture using the classic method "blackboard and chalk"; auditorium exercises solving a given problem.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent enabling the revision of existing paradigms – global achievements, including theoretical foundations and general issues and selected specific issues concerning the use of the method of limit states in the issues of durability of building structures
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) main development trends in the field of diagnostics of building structures and modern technologies of strengthening and renovation of building structures,
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) methodology of scientific research in the field of durability of structures within the discipline of civil engineering, geodesy and transport
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results for the discipline of civil engineering, geodesy and transport
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use the knowledge in the field of designing and diagnosing the technical condition and durability of buildings to creatively identify, formulate and innovatively solve complex problems in this area; perform research tasks, in particular: define the purpose and subject of scientific research, develop research methods, techniques and tools and creatively apply them, draw conclusions based on the results of scientific research
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical assessment of the achievements related to the design and diagnosis of durability of building structures within the discipline of civil engineering, geodesy and transport

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a		X		X		
P8S_WG_b		X		X		
P8S_WG_c		X		X		
P8S_WK_c		X		X		

P8S_UW_a		X		X		
P8S_KK_a				X		

6. LITERATURE

Basic Literature
1. Ściślewski J., Trwałość konstrukcji żelbetowych. Prace Naukowe ITB, Seria Monografie, Warszawa 1996 2. Drobiec Ł., Jasiński R., Piekarczyk A., Diagnostyka konstrukcji żelbetowych, Tom 1. Metodologia, badania polowe, badania laboratoryjne betonu i stali, Wydawnictwo Naukowe PWN, 2010 3. Zybura A., Jaśniok M., Jaśniok T., Diagnostyka konstrukcji żelbetowych, Tom 2. Badania korozji zbrojenia i właściwości ochronnych betonu, Wydawnictwo Naukowe PWN, 2014 4. Błaszczyński T., Trwałość budynków i budowli. Dolnośląskie Wydawnictwo Edukacyjne, 2012 5. Czarnecki L., Emmons P. H., Naprawa i ochrona konstrukcji betonowych. Polski Cement, Kraków 2002 6. Runkiewicz L., Wzmacnianie konstrukcji żelbetowych. ITB, Warszawa 2011 7. Nowak A. S., Collins K. R., Reliability of structures, McGraw-Hill, Boston 2000 8. Eleni N. Ch., Identification methods for structural health monitoring, Springer, 2016 9. Balu A. S., Rao B. N., Structural reliability bounds, LAMBERT Academic Publishing, 2012 10. Yan-Gang Z., Structural reliability: approaches from perspectives of statistical moments, John Wiley and Sons Ltd, 2021 11. Applicable standards
Additional Literature
1. Ściślewski Z., Ochrona konstrukcji żelbetowych. Arkady, Warszawa 1999 2. Król M., Tur W., Kondratczyk A., Beton ekspansywny do stosowanie w budownictwie. Katalog napraw i wzmocnień. Wydawnictwo Politechniki Lubelskiej, Lublin 1996 3. Masłowski E., Spiżewska D., Wzmocnienia konstrukcji budowlanych. Arkady, Warszawa 2000 4. Arendorski J., Trwałość i niezawodność budynków mieszkalnych, Arkady, Warszawa 1978 5. Biegus A. Probabilistyczna analiza konstrukcji stalowych, PWN, 1999 Warszawa 6. Machowski A., Zagadnienia stanów granicznych i niezawodności szkieletów stalowych budynków wielokondygnacyjnych, Wydawnictwo Politechniki Krakowskiej, Monografia 262, seria Inżynieria lądowa", Kraków 1999

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ilgit.IV
Item Name	**A block of subjects from the discipline of *civil engineering, geodesy and transport* to choose from: NEW GENERATION CONCRETES AND CONCRETE STRUCTURES**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Maciej Dutkiewicz, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. inż. Maciej Dutkiewicz, prof. PBŚ

1. The role of material modification in modern concrete technology – shaping the microstructure of concrete by using mineral additives and chemical admixtures.
2. Self-compacting concretes – introduction. Origin, essence and significance in construction. Self-Compacting Mixture Properties and Test Methods.
3. High-strength concretes – introduction. Development, classification, components of high-strength concrete and their importance. The use of high-strength concrete in construction
4. Safety of concrete structures in the limit state method. Material features adopted in design.
5. Idealization of construction. Steel and concrete models. Methods of structural analysis.
6. Concrete destruction and plasticizing strength. Analysis of cross-sections in elements with reinforcement.

3. TEACHING METHODS

Lecture – 15 hours
Classes will be conducted in the form of multimedia lectures. Distance learning is possible synchronously.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies to the extent that allows for the revision of existing paradigms – global achievements, including theoretical foundations and general issues and selected specific issues for the discipline of civil engineering, geodesy and transport, in particular the properties of modern cement composites,

	mechanics and identification of structural changes during the operation of concrete structures.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies main development tendencies for the discipline of civil engineering, geodesy and transport, in particular the development of methods for designing modern concrete structures
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies methodology of scientific research for the discipline of civil engineering and transport, in particular the development of methods for modeling and diagnostics of concrete structures
P8S_WK_c	Context – conditions, effects - basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results, for the discipline of civil engineering, geodesy and transport, taking into account the economic aspects of the use of modern cement composites.
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed b) use the knowledge for the discipline of civil engineering, geodesy and transport to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular the ability to apply the acquired knowledge in the field of cement composites in design, construction and operation.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements within the discipline of civil engineering, geodesy and transport, including the use of modern concretes in structures.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a		x				
P8S_WG_b		x				
P8S_WG_c		x				
P8S_WK_c		x				
P8S_UW_a		x				
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Gołaszewski J., 2021. Projektowanie betonu samozagęszczalnego. PWN, Warszawa
2. Łukowski P., 2016. Modyfikacja materiałowa betonu. Polski Cement, Kraków.
3. Jasiczak J., Wdowska A., Rudnicki T., 2008. Betony ultrawysokowartościowe. Właściwości, technologie, zastosowania. Stowarzyszenie Producentów Cementu, Kraków.
4. Szwabowski J., Gołaszewski J., 2010. Technologia betonu samozagęszczalnego. Stowarzyszenie Producentów Cementu, Kraków.
5. Knauff M., 2018. Obliczanie konstrukcji żelbetowych według Eurokodu 2. Wydawnictwo Naukowe PWN.
6. Pędziwiatr J., 2010. Wstęp do projektowania konstrukcji żelbetowych wg PN-EN 1992-1-1:2008. Dolnośląskie Wydawnictwa Edukacyjne
7. Golubińska A., Knauff M., Knyziak P., 2014. Tablice i wzory do projektowania konstrukcji żelbetowych z przykładami obliczeń. Wydawnictwo Naukowe PWN.

Additional Literature

1. Brandt A.M., 2009. Cement-Based Composites. Taylor & Francis Group, London and New York.
2. Neville A. M., 2012. Właściwości betonu. Stowarzyszenie Producentów Cementu, Kraków.
3. Kurdowski W., 2010. Chemia cementu i betonu. Wydawnictwo Polski Cement, Kraków, PWN Warszawa.
4. Starosolski W., 2012, Konstrukcje żelbetowe według Eurokodu 2 i norm związanych Tom 1. Wydawnicwo Naukowe PWN.
5. Łapko A., Jensen B. Christian, 2005, Podstawy projektowania i algorytmy obliczeń konstrukcji żelbetowych. Arkady, Warszawa

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ilgit.V
Item Name	**A block of subjects from the discipline of *civil engineering, geodesy and transport* to choose from: MODERN METAL STRUCTURES**
Course coordinator responsible for preparing the syllabus	dr inż. Rafał Tews

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr inż. Rafał Tews

Lecture:
Stability of steel structures – numerical approach, practical use of analysis results during the design of steel structure elements
FEM analysis of steel structure elements – classic (member) and advanced (shell and spatial elements) approaches
Plastic Analysis and Design of Steel Frames
Glued steel structures – characteristics of the adhesives used, principles of shaping joints, methods of calculating glued joints,
Aluminium structures – structure characteristics, dimensioning, basic construction problems
Project exercises:
Advanced numerical analysis of FEM of a selected node of a metal structure using shell or spatial elements.

3. TEACHING METHODS

Lecture - 10 hours
Project exercises – 5 hours

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent enabling the revision of existing paradigms – the world achievement, including theoretical foundations and general issues and selected specific issues for the discipline of civil engineering and transport
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) main development trends for the discipline of civil engineering and transport
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies (c) the methodology of the research in relation to metal structures

P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results, for the discipline of civil engineering and transport
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed b) use knowledge for the discipline of civil engineering and transport to creatively identify, formulate and innovatively solve complex problems or perform tasks of a research nature in relation to steel structures
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements within the discipline of civil engineering and transport

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c			x			
P8S_WK_c			x			
P8S_UW_a			x			
P8S_KK_a			x			

6. LITERATURE

Basic Literature

1. K. Rykaluk, Zagadnienia stateczności konstrukcji metalowych, DWE 2012,
2. M. Piekarczyk, Zastosowanie technologii klejenia w metalowych konstrukcjach metalowych, PK 2013,
3. M. Gwóźdź, Konstrukcje aluminiowe. Projektowanie według Eurokodu, PK 2014
4. N. S. Trahair et al. The behaviour and design of steel structures to EC3, Taylor & Francis 2008,
5. M. Bill Wong Plastic analysis and Design od Steel Structure, BH Elsevier 2009
6. K.J. Bathe – Finite Element Procedures, Prentice Hall 2014

Additional Literature

1. Sz, Pałkowski, Podstawy stateczności stalowych konstrukcji prętowych, 2016,
2. Journal of Constructional Steel Research - ScienceDirect platform

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ilgit.VI
Item Name	**A block of subjects from the discipline of *civil engineering, geodesy and transport* to choose from: WIND ENGINEERING**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Maciej Dutkiewicz, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. inż. Maciej Dutkiewicz, prof. PBŚ

1. Models describing the movement of air. Circulation of the Earth's atmosphere.
2. Phenomena of flow of bodies with different geometric characteristics. Application of CFD in wind engineering. Structure of winds in the ground layer.
3. The effects of wind on objects and people. Models of wind impact on buildings.
4. Specificity of wind impact on structures (towers, masts, cooling towers, suspension and suspended bridges). Reduction of vibrations caused by wind.
5. Strong wind impacts, wind scales, vortex models,
6. Principles of wind measurements. Wind comfort. Selected issues of wind energy.

3. TEACHING METHODS

Lecture – 15 hours
Classes will be conducted in the form of multimedia lectures. Synchronous and asynchronous distance learning is allowed.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies to the extent enabling the revision of existing paradigms – global achievements, including theoretical foundations and general issues and selected specific issues for the discipline of civil engineering, geodesy and transport, in particular in the field of wind engineering, wind scales, wind action on buildings.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies main development trends for the discipline of civil engineering, geodesy and transport, in particular modeling of strong winds
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies

	methodology of scientific research for the discipline of civil engineering, geodesy and transport, including research on the impact of wind on the response of a building structure.
P8S_WK_c	Context – conditions, effects - basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results, for the discipline of civil engineering, geodesy and transport, including wind engineering.
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed b) use the knowledge for the discipline of civil engineering, geodesy and transport to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular the ability to apply the acquired knowledge in the field of wind engineering in design, construction and operation.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical assessment of achievements within the discipline of civil engineering, geodesy and transport, including the use of modern wind models.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	…
P8S_WG_a		x				
P8S_WG_b		x				
P8S_WG_c		x				
P8S_WK_c		x				
P8S_UW_a		x				
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Flaga A., 2008, Inżynieria wiatrowa, Warszawa, Arkady.
2. Dyrbye C., Hansen S.O., 1997, Wind loads on structures, John Wiley &Sons, Baffins Lane, Chichester.
3. Holmes J.D., 2015. Wind Loading of Structures, Taylor & Francis Group, New York.
4. Simiu E., Scanlan R.H., 1996. Wind effects on structures: fundamentals and applications to design, John Wiley & Sons, New York

Additional Literature
1. Flaga A. Mosty dla pieszych, 2011, Warszawa, Wydawnictwa Komunikacji i Łączności 2. Tamura Y., Kareem A.,2013, Advanced Structural Wind Engineering.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.im.I
Item Name	**A block of subjects from the discipline *of mechanical engineering* to choose from: MACHINE AND PROCESS LIFE CYCLE**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Izabela Piasecka, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. inż. Izabela Piasecka, prof. PBŚ

1. **INTRODUCTION TO THE SUBJECT OF THE LIFE CYCLE OF MACHINES AND PROCESSES.** Basic definitions. Discussion of the stages of the life cycle of machines (formulation of needs, construction, production, operation, post-consumer development). Analysis of changes in the relationship between the economy and the environment.
2. **PROCESSES OF MANUFACTURING AND USING MACHINES IN THE CONTEXT OF THEIR LIFE CYCLE.** Utility functions of plastics, materials, elements, work units, machines and devices. The flow of matter and energy in the cycle of existence. Diagram of the course of production, operation and post-use development of machines in the context of their life cycle. Methods of environmental process assessment.
3. **LOADS INTRODUCED INTO THE ENVIRONMENT DURING THE LIFE CYCLE OF MACHINES.** Impact of industrial processes on the environment. Environmental burden as a result of the use of natural resources. Characteristics of pollutants introduced into the environment. Impact of industrial processes on the working environment.
4. **ENVIRONMENTAL IMPACTS CAUSED BY THE INTRODUCTION OF WORKLOADS INTO THE LIFECYCLE OF MACHINES.** Depletion of natural resources. Impact of pollution on human health. Climate. Degradation of the stratospheric ozone layer. Environmental pollution. Acidification and eutrophication. Effects of loads on materials. Other environmental effects (m.in. effects of noise and vibration, effects of load on the working environment).
5. **QUANTIFICATION OF THE EFFECTS OF IMPACT ON THE ENVIRONMENT IN THE LIFE CYCLE OF MACHINES.** Environmental loads that arise during the life cycle of machines. Cumulative ambient loads. Environmental interference and its effects on the environment. Methods of approach to quantification of the impact on the environment. Determination of cumulative environmental loads (including: classification and characterization of loads, methods of determining the load equivalent index, normalization and weighting of loads). Energy and environmental characteristics of machines. Determination of indicators of the category of impact on the environment.
6. **DETERMINATION OF CUMULATIVE ENVIRONMENTAL LOADS FOR THE PROCESSES OF MANUFACTURING MACHINES AND DEVICES.** Methods for determining the cumulative workloads of your environment. Methods of process analysis. A

method of a system of balance equations for a single material, material, element or work assembly and for a machine or machine park. Determine the cumulative water consumption rate.

7. **METHODOLOGY OF ENERGY AND ECOLOGICAL ANALYSES OF MACHINES FOR THE FULL LIFE CYCLE.** Principles of performing a full life cycle analysis. General information on the full life cycle methodology (including: the subject and purpose of the LCA analysis, stages and phases of the analysis, basic definitions in the LCA methodology). Defining the purpose and scope of the energy and ecological analysis. Inventory – collection of data and analysis of the set (including: calculation procedures and correction of the boundaries of the technical object's system, assignment of streams and releases, examples of data ordering procedures). Determination of the function unit and reference flux. Environmental impact assessment (including: determination of environmental impact categories, interpretation of analysis results, final report and critical review).
8. **THE ISSUE OF ENERGY AND ECOLOGICAL OPTIMIZATION OF MACHINES.** Performance properties and pro-ecological requirements for machines and equipment. A systemic approach to energy and ecological analysis (including: basic definitions, assessment criteria, system boundaries, system environment). A general formulation of the optimization problem. Possibilities to reduce the impact of the life cycle of machines on the environment (including: possibilities of impact in the design phase, impact of durability of plastics, materials and components, importance of the operating system in the consumption of resources and environmental impact, possibilities of impact on the consumption of materials, products and water).
9. **DETERMINE THE CUMULATIVE WORKLOADS OF YOUR ENVIRONMENT FOR THE FULL LIFECYCLE OF YOUR MACHINES.** Components of the environment workload. Determining the cumulative consumption of energy and non-energy resources. Determination of cumulative pollutant emissions and the amount of waste. Determining cumulative eco-cost and eco-cost.
10. **ENERGY AND ECOLOGICAL ANALYSIS OF A TECHNICAL FACILITY IN PRACTICE.** Remarks on the scope of energy and environmental analysis. Information about plastics, materials and components as well as manufacturing processes. Energy and ecological characteristics. Compilation of inventory data. Description of LCA analysis. Environmental impact assessment.
11. **COMPARATIVE ANALYSIS OF ENERGY AND ENVIRONMENTAL PERFORMANCE ON SELECTED EXAMPLES OF PLASTICS, MATERIALS, ELEMENTS, WORKING UNITS AND MACHINES.** Function unit and reference flux specifying. General principles of comparing plastics, materials, elements, working units and machines. Description of manufacturing processes. Notes on inventory and data acquisition. Energy and ecological characteristics and ways of comparing results. Discussing the results of the analysis.
12. **ENVIRONMENTAL DECLARATIONS.** Types of environmental declarations and general rules for their preparation. Type I, II and III environmental labels (including: basic rules of implementation, more important procedures required, participation of stakeholders in the preparation of declarations, methods of sharing, institutional bases for the functioning of the environmental declaration system).
13. **DIRECTIONS OF PRO-ECOLOGICAL MODERNIZATION OF MACHINES.** Sustainability strategy as a leading concept. Sustainability tools in the manufacture of plastics, materials, components, work assemblies and machines (including: integrated permits and best available technology, environmental management, cleaner production principle). Possibilities of

pro-ecological rationalization of machines in their life cycle (including: rational management of waste and post-consumer resources). Pro-ecological rationalization of energy production and use (including: increasing the efficiency of current energy technologies, improving environmental indicators in modern technologies, introducing new energy technologies, increasing the share of energy from renewable sources, rationalization of energy use).

14. **ECO-FRIENDLY DESIGN AND MACHINE DEVELOPMENT.** Tools for computer-aided eco-design of machines and devices. Characteristics of the GaBi software. Sustainable design capabilities in SolidWorks Sustainability. Procedure for conducting LCA analyses using the SimaPro tool.
15. **THE IDEA OF A CIRCULAR ECONOMY.** Introduction and key definitions. A closed way of managing the proximity to natural ecosystems. Examples of activities that bring management closer to a closed system.

3. TEACHING METHODS

Lecture - 15 hours
Multimedia lecture - discussion

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies: a) to the extent enabling the revision of existing paradigms – global achievements, including theoretical foundations and general issues and selected specific issues specific to the discipline of mechanical engineering, in particular in the field of assessment of the life cycle of machines and devices and the possibilities of their eco-design and development.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies: b) the main development trends of the discipline of mechanical engineering, with particular emphasis on the issues of pro-ecological modernization of machines and the idea of circular economy.
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies: (c) the methodology for mechanical engineering research, including Life Cycle Assessment (LCA).
P8S_WK_c	Context – conditions, effects: c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in relation to mechanical engineering, in particular in the area of pro-ecological design and optimization of machines and increasing energy, economic and ecological efficiency at various stages of their life cycle.
SKILLS: can	
P8S_UW_a	Use of knowledge – problems solved and tasks performed: a) use knowledge in the field of mechanical engineering to creatively identify, formulate and innovatively solve complex problems or perform research tasks, with particular emphasis on the issues of life cycle assessment

	of machines and equipment, their environmentally friendly modernization, sustainable development and circular economy.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Assessments – a critical approach: a) critical evaluation of achievements within the discipline of mechanical engineering, including environmental life cycle assessment (LCA), eco-design, modernization and development of machinery and equipment, in line with the assumptions of circular economy and sustainable development.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x		x	
P8S_WG_b			x		x	
P8S_WG_c			x		x	
P8S_WK_c					x	
P8S_UW_a			x		x	
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Flizikowski J.B., 2002: Rozprawa o konstrukcji, Wyd. Instytutu Technologii Eksploatacji.
2. Kłos Z., Kurczewski P., Kasprzak J., 2005: Środowiskowe charakteryzowanie maszyn i urządzeń, Wydawnictwo Politechniki Poznańskiej.
3. Górzyński J., 2007: Podstawy analizy środowiskowej wyrobów i obiektów, WNT, Warszawa.
4. Guineé J., 2002: Handbook on Life Cycle Assessment. Operational Guide to the ISO Standards, Springer Science + Business Media B.V.
5. Lewandowska A.,2006: Środowiskowa ocena cyklu życia produktu na przykładzie wybranych typów pomp przemysłowych, Wyd. Akademii Ekonomicznej w Poznaniu.

Additional Literature

1. Curran M.A., 2015: Life Cycle Assessment Student Handbook, John Wiley&Sons Inc.
2. Flizikowski J., Bieliński K., 2000: Projektowanie środowiskowych procesorów energii, Wydawnictwa Uczelniane Akademii Techniczno-Rolniczej, Bydgoszcz.
3. Klöpffer W., Grahl B., 2014: Life Cycle Assessment (LCA): A Guide to Best Practice. John Wiley&Sons Inc.
4. Legutko S., 2007: Eksploatacja maszyn, Wydawnictwo Politechniki Poznańskiej.
5. Merkisz-Guranowska, A., 2007: Recykling samochodów w Polsce, Wyd. Instytutu Technologii Eksploatacji.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.im.II
Item Name	**A block of subjects in the discipline of *mechanical engineering* to choose from: SYSTEMS ENGINEERING**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Łukasz Muślewski, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr hab. inż. Łukasz Muślewski, prof. PBŚ

The subject is carried out in the discipline: mechanical engineering.
The thematic scope of the classes includes:
- introduction to general systems theory,
- analysis of the concept and definition of systems,
- characteristics of issues in the field of systems engineering,
- identification of the purpose of the system,
- system construction,
- system structure,
- a set of system elements,
- system decomposition,
- assessment of the condition and behavior of the system,
- analysis and synthesis of the system,
- division and characteristics of system models,
- characteristics of the system environment.

3. TEACHING METHODS

Lecture – 15 hours
The subject is carried out in the form of a lecture.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	The student has the knowledge to revise the existing paradigms in the field of general systems theory, and in particular knows the world achievements including theoretical foundations and general issues and selected specific issues concerning the functioning of technical systems.
P8S_WG_b	The student knows and understands the main development trends in the construction and operation of complex technical systems.

P8S_WG_c	The student has knowledge of the methodology of scientific and engineering research in the field of construction and evaluation of the performance of technical systems.
P8S_WK_c	The student knows and understands the basic principles of knowledge transfer to the economic and social sphere and the commercialization of the results of scientific activity and the know-how related to these results in relation to the functioning of technical systems.
SKILLS: can	
P8S_UW_a	The student is able to use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks in relation to the construction and functioning of complex technical systems. He/she is able to define the purpose and object of scientific research, formulate a research hypothesis, develop research methods, techniques and tools and creatively apply them, draw conclusions based on the results of scientific research.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	The student is ready to critically evaluate the achievements within a given research discipline and solutions in the field of general theory of technical systems.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c			x			
P8S_WK_c			x			
P8S_UW_a			x			
P8S_KK_a			x			

6. LITERATURE

Primary Literature

1. Weinberg G.M., Myślenie systemowe. Wydawnictwo Naukowo-Techniczne, Warszawa 1979.
2. Praca zbiorowa pod redakcją G.J. Klira, Ogólna teoria systemów. Wydawnictwo Naukowo-Techniczne, Warszawa 1976.
3. Woropay M., Muślewski Ł., Jakość w ujęciu systemowym. Instytut Technologii Eksploatacji, Radom 2005.
4. Sage A.P., System engineering. Willey, New York 1992.
5. Sienkiewicz P., Inżynieria systemów. Wydawnictwo Ministerstwa Obrony Narodowej, Warszawa 1983.

Additional literature
1. Benes J., Teoria systemów. Państwowe Wydawnictwo Naukowe, Warszawa 1979. 2. Szymański J.M., Życie systemów. WiedzaPowszechna, Warszawa 1991. 3. Oliver D.W. Engineering complex systems with models and objects.McGraw-Hill, New York 1997. 4. Kazimierczak J., System cybernetyczny. Wiedza Powszechna, Warszawa 1978. 5. Ziemba S., Jarominek W., Staniszewski R., Problemy teorii systemów. Zakład Narodowy imienia Ossolińskich – Wydawnictwo, Wrocław 1980.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.im.III
Item Name	**A block of subjects from the discipline of *mechanical engineering* to choose from: MATERIALS SCIENCE**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Dariusz Sykutera, prof. PBŚ

1. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr hab. inż. Dariusz Sykutera, prof. PBŚ

*- subject taught separately in a group of disciplines

Introduction to materials science – world data, classification. Microstructure and Consistency of Materials. Elasticity, ductility, stiffness and strength of materials. Mechanical strength and fracture toughness. Creep phenomenon. Thermal properties of materials. Shaping material properties. Hybrid composites. Lightweight construction materials. Material selection strategies in eco-design using the CES (Cambridge) base.

2. TEACHING METHODS

Lecture – 15 hours of lecture, synchronous distance learning

3. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies: a) to the extent that allows for the revision of existing paradigms – the world achievements, including theoretical foundations and general issues and selected specific issues specific to materials science.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies: b) the main development trends in the field and construction of single- and multi-phase materials, especially structural materials.
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies: c) methodology of scientific research in the field of materials testing.
P8S_WK_c	Context – conditions, effects: c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in relation to the production and testing of single- and multi-phase materials.
SKILLS: can	

P8S_UW_a	Use of knowledge – problems solved and tasks performed: a) use knowledge in the field of materials science to creatively identify, formulate and innovatively solve complex problems or perform research tasks.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Assessments – a critical approach: a) critical evaluation of achievements in materials science.

4. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c					x	
P8S_WK_c					x	
P8S_UW_a					x	
P8S_KK_a					x	

5. LITERATURE

Basic Literature

1. Callister Jr. W. D., Rethwisch D. G.: Materials Science and Engineering: An Introduction 9th Edition. WileyPLUS. 2022.
2. Miodownik M. Stuff Matters: Exploring the Marvelous Materials that Shape Our Man-Made World. Amazon. New York 2021.
3. Ashby M., Cebon D., Shercliff H., Ashby M. F.: Inżynieria materiałowa, Tom 1-2. Wydawnictwo Galaktyka, 2011.

Additional Literature

1. Dobrzański L.A.: Podstawy nauki o materiałach i metaloznawstwo. WNT, Warszawa 2002.
2. Blicharski M.: Inżynieria materiałowa. Wydawnictwo Naukowe PWN. Warszawa 2017.
3. Kubiński W.: Materiałoznawstwo, Tom 1. Podstawowe materiały stosowane w technice. Wydawnictwo naukowe AGH, Kraków 2012.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.im.IV
Item Name	**A block of subjects from the discipline of *mechanical engineering* to choose from:** **ANALYTICAL MECHANICS**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Dariusz Skibicki

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	prof. dr hab. inż. Dariusz Skibicki

*- subject taught separately in a group of disciplines

Newtonian mechanics vs. analytical mechanics. Mathematical basis: calculus of variations. Degrees of freedom. Referential. Generalized coordinates. Generalized forces. Virtual Shift. D'Alebert's principle. The principle of virtual work. Derivation of the Lagrange equation. Lagrange mechanics. Operation and its minimization. Hamiltonian mechanics: Hamiltonian equations.

3. TEACHING METHODS

Lecture - 15 hours

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies: a) to the extent that it is possible to understand and revise the existing paradigms of classical mechanics, i.e. Newtonian, Lagrange and Hamiltonian mechanics.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies: b) the main historical tendencies in the development of classical mechanics
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies: c) methodology of scientific research in the field of mechanical engineering.
P8S_WK_c	Context – conditions, effects: c) possible principles of transfer of knowledge in the field of mechanics to the economic and social sphere and commercialization of the results of scientific activity
SKILLS: can	
P8S_UW_a	Use of knowledge – problems solved and tasks performed:

	a) use knowledge of classical mechanics to creatively identify, formulate and innovatively solve complex problems
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Assessments – a critical approach: a) critical evaluation of achievements within a given discipline of mechanical engineering in the field of problems of classical mechanics.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c			x			
P8S_WK_c			x			
P8S_UW_a			x			
P8S_KK_a			x			

6. LITERATURE

Basic Literature

1. Janusz Zachwieja. Wykłady z mechaniki analitycznej. Wydawnictwa uczelniane Uniwersytetu Technologiczno-Przyrodniczego w Bydgoszczy, 2016.
2. Jan Awrajcewicz. Mechanika techniczna. Wydawnictwa Naukowo-Techniczne, 2009.

Additional Literature

1. Patrick Hamill. A Student's Guide to Lagrangians and Hamiltonians. Cambridge University Press, 2014.
2. Susskind Leonard, Friedman Art. Mechanika kwantowa. Teoretyczne minimum. Prószyński Media. 2016.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.im.V
Item Name	**A block of subjects from the discipline of *mechanical engineering* to choose from:** **FINITE ELEMENT METHOD**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Dariusz Skibicki

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	prof. dr hab. inż. Dariusz Skibicki

*- subject taught separately in a group of disciplines

Lecture 1. Introduction to FEM.
The idea of a finite element. Stiffness matrix. Matrix aggregation. Solving a system of equations with respect to displacement. Shape function. Calculation of strains and stresses. Preprocessor, solver, and postprocessor. Types of FEM analyses.

Lecture 2. Basics of matrix calculus and solid state mechanics.
Types of matrices and operations on matrices. Form and volume deformation. Stress. Hook's Law.

Lecture 3 and 4. Member element.
A single item. Stiffness matrix. Shape function. Determination of deformations. Stress determination. Many elements. Matrix aggregation. Boundary conditions. Solving the Block FEM Equation. Discretization error. Any position of the elements. Transformation of the stiffness matrix.

Lecture 5. Triangular element
Displacement. Shape features. Strain. Hook's Law. Stiffness matrix.

Lecture 6. Quadrangular element
Displacement. Iso-parametric transformation. Hook's Law. Determination of deformations and stresses. Stiffness matrix of the iso-parametric element. The effect of the shape of the element on accuracy. Measures of component quality.

Lecture 7. Methods for solving the FEM task
Newton's method and derived methods. Dynamics in FEM. Explicit method.

3. TEACHING METHODS

Lecture – 15 hours Lecture - classes are conducted in the form of a lecture. The lecture is enriched with presentations of practical aspects of FEM in the Fusion program.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies: a) to the extent that it is possible to revise the existing paradigms of mechanical engineering in relation to numerical methods, in particular the finite element method.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies: b) the main development tendencies of the discipline of mechanical engineering, especially computational methods, including the finite element method
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies: c) methodology of conducting scientific research in the field of mechanical engineering, especially computational methods
P8S_WK_c	Context – conditions, effects: c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of numerical calculations in the field of solid state mechanics
SKILLS: can	
P8S_UW_a	Use of knowledge – problems solved and tasks performed: a) use knowledge of mechanical engineering to creatively identify, formulate, and innovatively solve complex solid state mechanical problems
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Assessments – a critical approach: a) critical evaluation of achievements within the discipline of mechanical engineering, especially numerical methods in relation to solid state mechanics.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c			x			
P8S_WK_c			x			
P8S_UW_a			x			
P8S_KK_a			x			

6. LITERATURE

Basic Literature
1. Skibicki Dariusz, Nowicki Krzysztof. Metody numeryczne w budowie maszyn, Wydawnictwa Uczelniane Akademii Techniczno-Rolniczej w Bydgoszczy, 2006. 2. Gustaw Rakowski, Zbigniew Kacprzyk. Metoda elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza Politechniki Warszawskiej, 2016.
Additional Literature
1. David V. Hutton. Fundamentals of Finite Element Analysis, McGraw-Hill Science/Engineering/Math, 2003. 2. Daryl L. Logan. A First Course in the Finite Element Method. Cl Engineering, 2016.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.im.vii
Item Name	**A block of subjects from the discipline *of mechanical engineering* to choose from: THEORY OF ELASTICITY AND PLASTICITY**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Łukasz Pejkowski, prof. PBŚ

2. DIVISION INTO SEMESTERS, NUMBER OF HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr hab. inż. Łukasz Pejkowski, prof. PBŚ

*- subject taught separately in a group of disciplines

The program content is divided into the following topics:

1. Physical mechanisms of material deformation.
2. Elements of the mechanics of continuous media. Stress state and strain state.
3. Basic equations of linear theory of elasticity.
4. Experimental observations.
5. Ductility in uniaxial stress state.
6. Strain hypotheses.
7. General constitutive rights. Plasticity surface, plastic potential, associated plastic flow.
8. Isotropic hardening model.
9. Kinematic reinforcement model.
10. Influence of strain velocity on constitutive behavior of materials.

3. TEACHING METHODS

Lecture - 15 hours
Multimedia lecture

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies: a) to the extent that allows for the revision of the existing paradigms of mechanics – including theoretical foundations and general issues and selected specific issues of the theory of elasticity and plasticity of engineering materials.

P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies: b) the main developmental tendencies of the theory of elasticity and, above all, plasticity, including cyclic plasticity
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies: c) methodology of scientific research conducted in the field of the theory of elasticity and plasticity, especially cyclic used in modeling fatigue processes.
P8S_WK_c	Context – conditions, effects: c) basic principles of knowledge transfer to the economic and social sphere and commercialization of results obtained by methods specific to the theory of elasticity and plasticity
SKILLS: can	
P8S_UW_a	Use of knowledge – problems solved and tasks performed: a) use knowledge in the field of mechanical engineering to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the field of the theory of elasticity and plasticity
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Assessments – a critical approach: a) critical evaluation of achievements in the field of basic issues of the theory of elasticity and plasticity

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c			x			
P8S_WK_c			x			
P8S_UW_a			x			
P8S_KK_a			x			

6. LITERATURE

Basic Literature

1. Jean Lemaitre, Jean-Louis Chaboche, Mechanics of Solid Materials, Cambridge University Press, 1990
2. L.S. Srinath, Advanced Mechanics of Solids, McGraw-Hill, 2009
3. Akhtar S. Khan, Sujian Huang, Continuum Theory of Plasticity, John Wiley & Sons, 1995
4. J. Chakrabarty, Theory Of Plasticity, Elsevier Butterworth-Heinemann, 2006
5. Stephen P. Timoshenko, J. N. Goodier, Theory of Elasticity, McGraw-Hill, 1970

Additional Literature

1. Michał Życzkowski, Obciążenia złożone w teorii plastyczności, PWN, 1973
2. Andrzej Gawęcki, Mechanika materiałów i konstrukcji prętowych, Politechnika Poznańska, 2003

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.ititaeeitk. And
Item Name	**Block of subjects in the discipline of *information and communication technology; automation, electronics, electrical engineering and space technologies* to choose from:** **EFFICIENT ENERGY CONVERSION IN AGRICULTURAL TECHNOLOGY**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Leszek Szychta

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	prof. dr hab. inż. Leszek Szychta
Introduction to industrial process automation. Industrial automation components. Energy Efficiency Act. Losses in the water supply system and characteristics of the pumping system. Flow characteristics and pump efficiency. Pump efficiency characteristics for different heads. Control of the pump system by throttling. Cascade, inverter and optimal control principle and the effect on energy efficiency. Control quality factor in the energy efficiency assessment.		

3. TEACHING METHODS

Lecture – 15 hours
Classes conducted in the form of a lecture.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Knows and understands to the extent that allows the revision of existing paradigms in the field of global achievements, including theoretical issues and the possibilities of their implementation and selected specific issues in the field of rational energy management in agricultural technology in the scientific disciplines of technical informatics and telecommunications as well as automation, electronics, electrical engineering and space technologies
P8S_WG_b	Knows and understands the direction of development of scientific research in the field of energy efficiency in the scientific disciplines of technical informatics and telecommunications as well as automation, electronics, electrical engineering and space technologies

P8S_WG_c	Knows the methodology of scientific research in the field of known control systems in devices used in agricultural technology in the field of scientific disciplines: technical informatics and telecommunications as well as automation, electronics, electrical engineering and space technologies
P8S_WK_c	Knows the principles of knowledge transfer in the field of effective application of modern energy management solutions to the economic sphere through the commercialization of the results of scientific activity in the following scientific disciplines: technical computer science and telecommunications as well as automation, electronics, electrical engineering and space technologies
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed Is able to independently solve problems in the field of energy-efficient control of equipment in the field of agricultural technology by using knowledge from various fields of science, formulating and innovative solving of complex interdisciplinary problems affecting the preservation of biodiversity or performing other complex research tasks in scientific disciplines: technical informatics and telecommunications as well as automation, electronics, electrical engineering and space technologies
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Is ready to undertake a thorough analysis of research processes occurring in the field of control systems, taking into account the broadly understood impact on the environment, critically evaluates the achievements within the scientific disciplines: technical informatics and telecommunications as well as automation, electronics, electrical engineering and space technologies

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c					x	
P8S_WK_c					x	
P8S_UW_a					x	
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Turowski J.: Podstawy mechatroniki, WSHE, 2008.
2. Jaszczuk W. i inni: Mikrosilniki elektryczne. Badanie właściwości statycznych i dynamicznych. PWN, Warszawa, 1991.
3. Turowski J.: Elektromaszynowe elementy automatyki. Politechnika Łódzka, Łódź, 1989
4. Olszewski M (redakcja): Podstawy mechatroniki, Rea, 2006

5. Gardner J.W., Varadan V. K., Awadelkarim O.O.: Microsensors MEMS and Smart Devices. J.Wiley, 2001

Additional Literature

1. Jędral W. Pompy wirowe, OWPW,2014,
2. Pump Life Cycle Costs: A guide to LCC Analysis for pumping systems, Europump and Hdraulic Institute,
3. Viholainen J., Energy efficient control strategies for variable driven pumping systems based on pump operation point monitoring with frequency converters, Acta Universitas Lappeenrantaensis2014.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.itit,aeeitk.II
Item Name	**Block of subjects in the discipline of *information and communication technology; automation, electronics, electrical engineering and space technologies* to choose from:** **DIGITAL SIGNAL PROCESSING**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Rafał Długosz, prof. PBŚ

3. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. inż. Rafał Długosz, prof. PBŚ

Sampling process. The process of quantizing. Transformata Z. Finite impulse response filters (FIR. Infinite Impulse Response (IIR) filters. Differential equation of the filter. Filter transmittance. Frequency characteristics of the filter. Low-, high-, mid-pass and mid-stop filters. Non-linear filters (erosion, expansion joint, median). Morphological operations. Designing filters. Ways to implement filters. Implementation inaccuracies of FIR filter coefficients and their impact on frequency responses. The use of filters in industrial applications, medicine and scientific research. Programs for the analysis and simulation of various signal processing techniques.

4. TEACHING METHODS

Lectures – 15 hours

5. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Knows and understands the structure and principle of operation of signal processing methods and algorithms
P8S_WG_b	Knows and understands modern trends related to the development of digital signal processing methods and knows programs for the implementation of selected algorithms in this area and their research
P8S_WG_c	Knows and understands the possibilities of using signal processing methods in industry, medicine and scientific research
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results
SKILLS: can	

P8S_UW_a	Can design a selected digital filter for given parameters.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	He is ready to critically analyze the results of his research

6. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a	x					
P8S_WG_b	x					
P8S_WG_c	x					
P8S_WK_c				x		
P8S_UW_a				x		
P8S_KK_a					x	

7. LITERATURE

Basic Literature

1. Tomasz P. Zieliński, Cyfrowe przetwarzanie sygnałów, Od teorii do zastosowań, Wydawnictwa Komunikacji i Łączności (WKŁ), Warszawa 2005, 2021
2. Gérard Blanchet, Maurice Charbit, Digital signal and image processing using MATLAB, ISTE Ltd, 2006
3. Adam Dąbrowski (red.), Przetwarzanie sygnałów przy użyciu procesorów sygnałowych, Wydawnictwo Politechniki Poznańskiej, 1998, 2000

Additional Literature

1. Gaurav Sharma, Digital Color Imaging Handbook, CRC Press 2003

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.itit,aeeitk. III
Item Name	**Block of subjects in the discipline of *information and communication technology; automation, electronics, electrical engineering and space technologies* to choose from:** **ARTIFICIAL INTELLIGENCE AND MODERN METHODS OF DATA PROCESSING IN SCIENTIFIC RESEARCH**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Tomasz Talaśka, prof. PBŚ

3. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30**	dr hab. inż. Tomasz Talaśka, prof. PBŚ

Artificial Intelligence, Algorithms, methods and techniques of artificial intelligence. Artificial neural networks, genetic algorithms, expert systems, fuzzy systems, fuzzy neural networks, machine learning, swarming systems, metaheuistic algorithms. Methods of implementing artificial intelligence algorithms. The use of artificial intelligence in industrial applications, medicine and scientific research. Data filtration and security. Programs for the analysis and simulation of various artificial intelligence techniques.

4. TEACHING METHODS

Lectures – 15 hours, project exercises – 15 hours.

5. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Knows and understands the structure and principle of operation of artificial intelligence algorithms
P8S_WG_b	Knows and understands modern trends related to artificial intelligence and data processing, and knows programs for the implementation of selected algorithms and their research
P8S_WG_c	Knows and understands the possibilities of using artificial intelligence in industry, medicine and scientific research
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results
SKILLS: can	

P8S_UW_a	Can model a selected object, phenomenon or process using artificial intelligence algorithms
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	He is ready to critically analyze the results of his research

6. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a	x					
P8S_WG_b	x					
P8S_WG_c	x					
P8S_WK_c				x		
P8S_UW_a					x	
P8S_KK_a					x	

7. LITERATURE

Basic Literature

1. Leszek Rutkowski, Metody i techniki sztucznej inteligencji, Wydawnictwo Naukowe PWN, 2021
2. Aurelien Geron, Uczenie maszynowe z użyciem Scikit-Learn I TensorFlow, Helion, 2020
3. Aglae Bassens, Grant Beyleveld, Jon Krohn, Uczenie głębokie i sztuczna inteligencja, Helion, 2021

Additional Literature

1. Adam Niewiadomski, Zbiory rozmyte typu 2 : zastosowania w reprezentowaniu informacji, Exit, 2019
2. Maciej Piliński , Danuta Rutkowska , Leszek Rutkowski, Sieci neuronowe, algorytmy genetyczne i systemy rozmyte, PWN, 1999
3. Kamila Migdał Najman, Krzysztof Najman, Samouczące się sztuczne sieci neuronowe w grupowaniu i klasyfikacji danych. Teoria i zastosowania w ekonomii, ebook, 2013

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.itit,aeeitk.IV
Item Name	**Block of subjects in the discipline of *information and communication technology; automation, electronics, electrical engineering and space technologies* to choose from:** **MANAGING THE OPERATION OF CURRENT AND FUTURE ENERGY SYSTEMS**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Sławomir Cieślik, prof. PBŚ

3. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. inż. Sławomir Cieślik, prof. PBŚ

Energy in satisfying human needs, especially in the lowest layer of Maslow's pyramid. The essence of heat and electricity in everyday life. Modern systems for generating, transmitting, storing and converting energy. Concepts of energy systems in the absence of fossil fuels. Trajectories of the transformation of current energy systems to the postulated systems by 2050.
The essence of managing the operation of energy systems. Limitations resulting from the physics of energy systems. Energy efficiency in energy processing, transmission and storage. Maximize the use of renewable energy sources. The use of artificial intelligence in the processes of managing the operation of energy systems.
Mathematical modeling of power system operating states and real-time digital simulation. The method of electric poles (steady and transient states). Examples of applications in the GNU Octeve environment. Examples of the use of digital simulators working in real time in the process of managing the operation of power systems.

4. TEACHING METHODS

The classes are conducted in the form of a lecture containing a demonstration of creating applications in the GNU Octave environment.
As part of your own work, you should solve a given problem (own task) and present the results in the form of a report.
The lecture is credited on the basis of a written colloquium. In addition, the report on the performance of the own task is evaluated. In order to pass the course, it is necessary to pass the colloquium and positively evaluate the report.

5. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	

P8S_WG_a	Knows the paradigms of the importance of energy for humanity and understands the need to manage the operation of energy systems, especially in the absence of fossil fuels.
P8S_WG_b	Understands the need for the development of breakthrough innovations in the sectors of broadly understood energy processes.
P8S_WG_c	Knows selected methods of mathematical modeling and understands simple ways of their application used in contemporary scientific research in the field of management of energy systems.
P8S_WK_c	Knows and understands the need to use advanced simulation methods in the economic and social spheres related to the management of power systems.
SKILLS: can	
P8S_UW_a	Can effectively and responsibly apply knowledge from the methods of mathematical modeling of power systems to the creative development of innovative solutions of a breakthrough nature in the field of power system operation management.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	He is ready to evaluate the solutions proposed in the literature based on interdisciplinary scientific achievements (technical information technology and telecommunications as well as automation, electronics, electrical engineering and space technologies).

6. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Report on own task	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c			x	x		
P8S_WK_c			x			
P8S_UW_a				x		
P8S_KK_a				x		

7. LITERATURE

Basic Literature

1. Paska J., Wytwarzanie rozproszone energii elektrycznej i ciepła. Oficyna Wydawnicza Politechniki Warszawskiej, 2010.
2. Horyński M.B., Energooszczędne zautomatyzowane systemy zarządzania energią w budynkach mieszkalnych. Politechnika Lubelska, 2015.
3. Cieślik S., Mathematical Modeling of the Dynamics of Linear Electrical Systems with Parallel Calculations. Energies, 14, 2930, 2021 (https://doi. org/10.3390/en14102930).

Additional Literature

1. Kaproń H., Kaproń T., Efektywność wytwarzania i dostawy energii w warunkach rynkowych. Kaprint, 2016.
2. Freris L., Infield D., Renewable Energy in Power Systems. WILEY John Wiley & Sons, 2008.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.itit,aeeitk.V
Item Name	**Block of subjects in the discipline of *information and communication technology; automation, electronics, electrical engineering and space technologies* to choose from:** **PROJECT, TEAM AND SOCIAL COMMUNICATION MANAGEMENT**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Michał Choraś

3. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30**	prof. dr hab. inż. Michał Choraś / dr hab. inż. Witold Hołubowicz, prof. PBŚ

The subject concerns the so-called soft skills.
The principles of communication (oral, written), teamwork and cooperation, work in a multicultural environment, as well as the principles of project and team management (including research) will be presented.
Tips will be presented on effective presentations, organizing effective meetings, sending e-mails, effective negotiations, and communication in a multicultural environment.
The principles of project management, including research projects, will be presented. Agile methodologies will also be discussed.
Practical situations and examples from real projects, in particular research projects, will be discussed.

4. TEACHING METHODS

Seminar – 15 hours
Seminar and project elements. Some classes are possible in a remote, asynchronous form.

5. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent enabling the acquisition of IT project management skills
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies

	b) to the extent enabling the acquisition of communication and teamwork skills during the implementation of projects
P8S_WG_c	Context – conditions, effects c) methodology of scientific research in the scientific disciplines of technical informatics and telecommunications as well as automation, electronics, electrical engineering and space technologies
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in the scientific disciplines of technical informatics and telecommunications as well as automation, electronics, electrical engineering and space technologies
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks in projects in the scientific disciplines of technical informatics and telecommunications as well as automation, electronics, electrical engineering and space technologies
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements within the scientific disciplines of technical informatics and telecommunications as well as automation, electronics, electrical engineering and space technologies

6. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Oral exam	Written exam	Presentation	Discussion	Academic Essay
P8S_WG_a			X		
P8S_WG_b			X		
P8S_WG_c			X		
P8S_WK_c			X		
P8S_UW_a			X		
P8S_KK_a			X		

7. LITERATURE

Basic Literature
-
Additional Literature

-

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nch.I
Item Name	**A block of subjects from the discipline of *chemical sciences* to choose from:** **TECHNICAL THERMODYNAMICS**
Course coordinator responsible for preparing the syllabus	dr Jacek Siódmiak

1. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30***	dr Jacek Siódmiak

*- subject taught separately in a group of disciplines

Thermodynamic system and state parameters: intensive and extensive state parameters, zero law of thermodynamics, concepts of heat and work and their relationship with energy, basics of balancing.
Thermodynamic factors and equation of state: ideal gas, ideal and semi-perfect gas, equation of state of real gas.
Specific heat: specific heat of ideal gases, heat capacity, specific heat-temperature dependency and average specific heat.
First law of thermodynamics: conservation of energy, internal energy, enthalpy.
First law of thermodynamics for closed and open systems, internal energy and enthalpy as state functions.
Thermodynamic transformations; characteristic transformations of ideal and semi-ideal gases, reversible and irreversible transformations.
Thermodynamic cycles: the concept of cycle, types of cycles, energy efficiency of the cycle.
Second law of thermodynamics: formulation of the second law of thermodynamics and concept of entropy, reversible Carnot cycle, thermodynamic temperature scale.

2. TEACHING METHODS

Lecture – 15 hours

Multimedia lecture, classes with the use of computer applications/simulations, seminar

3. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – the world achievement, including theoretical foundations and general issues and

	selected specific issues in the field of thermodynamic processes specific to chemical and technical sciences
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) the main development trends of the discipline of chemical sciences, in particular in the field of the efficiency of thermodynamic processes
P8S_WG_c	Context – conditions, effects c) methodology of scientific research in chemical sciences, in particular thermodynamic processes based on the basic laws of physics,
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in the field of chemical sciences, in particular in the field of improving the efficiency of thermodynamic processes,
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge of thermodynamic processes to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the field of chemical and technical sciences
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of the achievements and media reports on innovative solutions in the field of processes and technical devices in which thermodynamic processes take place

4. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a				x	x	
P8S_WG_b				x	x	
P8S_WG_c				x	x	
P8S_WK_c				x	x	
P8S_UW_a				x	x	
P8S_KK_a				x	x	

5. LITERATURE

Basic Literature

1. S. Wiśniewski, *Termodynamika techniczna*, PWN Warszawa, 2017.
2. D. Halliday, R. Resnick, J. Walker, *Podstawy fizyki – tom 2*, PWN Warszawa, 2014.
3. S.R. de Groot, P. Mazur, *Non-equilibrium Thermodynamics*, Dover, New York, 1984.
4. P. Atkins, J. de Paula, *Physical Chemistry*, Oxford University Press, Oxford, United Kingdom, 2014.

Additional Literature
1. A.W. Adamson, A.P. Gast, *Physical Chemistry of Surface,* Wiley-Interscience, New York, 1997. 2. J. E. Verwey, J. T. G. Overbeek, *Theory of The Stability of Lyophobic Colloids,* Elsevier, Amsterdam, 1948. 3. P. Flory, *Principles of Polymer Chemistry;* Cornell University Press: Ithaca, NY, USA, 1953.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nch.II
Item Name	**A block of subjects from the discipline of *chemical sciences* to choose from:** **HOT TOPICS IN MODERN PHYSICS**
Course coordinator responsible for preparing the syllabus	prof. dr hab. Sylwia Zielińska-Raczyńska

1. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	prof. dr hab. Sylwia Zielińska-Raczyńska

7 meetings, each will discuss different issues related to the most modern achievements in modern physics and computer science, in particular quantum physics. The lectures will be based on publications describing the latest reports from "Nature" (IF=38) and "Science" (IF=41), i.e. scientific journals with the highest impact index in science. The subject matter will concern the most contemporary trends in basic research, constituting the basis for further technological concepts and know-how in the development of civilization.
The basic assumption of such a series of lectures is to track progress, hence the subject matter will be
updated every year.

2. TEACHING METHODS

lecture (8 hours) seminars (7 hours)
multimedia lecture and accompanying discussion some issues will be discussed in a conversational form

3. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – the world achievement, including theoretical foundations and general issues and selected specific issues specific to the chemical sciences
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) the main development trends of the discipline of chemical sciences
P8S_WG_c	Context – conditions, effects c) the methodology of scientific research of chemical sciences
P8S_WK_c	Context – conditions, effects

	c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in the field of chemical sciences
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the field of chemical sciences
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements in the field of chemical sciences

4. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a					X	X
P8S_WG_b					X	X
P8S_WG_c					X	X
P8S_WK_c					X	X
P8S_UW_a					X	X
P8S_KK_a					X	X

5. LITERATURE

Basic Literature

1. J.C. Garrison, R.Y. Chiao, *Quantum optics,* Oxford University Press, Oxford, New York 2012
2. Ian Stewart, *17 równań, które zmieniły świat*, Warszawa 2013
3. Michito Kaku, *Fizyka przyszłości: nauka do 2100 roku*, Warszawa 2021
4. Frank Wilczek, *Lekkość bytu; masa, eter i unifikacja sił,* Warszawa 2011
5. Kenneth W. Ford, *101 kwantowych pytań; wszystko co chcielibyście wiedzieć o świecie, którego nie widać,* Warszawa 2021
6. Pozostałe pozycje literaturowe będą podawana na bieżąco, w trakcie zajęć.

Additional Literature

1. Frank Close, *Zagadka nieskończoności*, Warszawa 2013
2. Lee Smolin, *Kłopoty z fizyką*, Warszawa 2008
3. Ian Stewart, *Czy Bóg gra w kości? Nowa matematyka chosu,* Warszawa 1994

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nch. III
Item Name	**A block of subjects from the discipline of *chemical sciences* to choose from:** **POLYMER NANOCOMPOSITES**
Course coordinator responsible for preparing the syllabus	dr inż. Katarzyna Skórczewska dr inż. Krzysztof Lewandowski

1. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr inż. Katarzyna Skórczewska dr inż. Krzysztof Lewandowski

*- subject taught separately in a group of disciplines

The concept of nanotechnology, polymer nanocomposites and directions of their development.
Overview of nanoadditives used.
Properties of polymer nanocomposites – methods of assessing their properties and structure
Modern methods of producing polymer nanocomposites – research and practical aspect.
Physical and chemical modifications of nanofillers.
Problems in the production of polymer nanocomposites
Contemporary and future directions of application of polymer nanocomposites.
Opportunities and threats in the production and application of nanoadditives and polymer nanocomposites.
Design and implementation of a research program in terms of solving research and practical problems related to polymer nanocomposites.

2. TEACHING METHODS

Lecture – 15 hours
Multimedia lecture, discussion.

3. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – the world achievement, including theoretical foundations and general issues and selected specific issues specific to the chemical sciences
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) the main development trends of the discipline of chemical sciences
P8S_WG_c	Context – conditions, effects c) the methodology of scientific research of chemical sciences

P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in the field of chemical sciences
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the field of chemical sciences
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements in the field of chemical sciences

4. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x		x	
P8S_WG_b			x		x	
P8S_WG_c			x		x	
P8S_WK_c			x		x	
P8S_UW_a			x		x	
P8S_KK_a			x		x	

5. LITERATURE

Basic Literature

1. Praca zbiorowa pod redakcją A. Świderskiej -Środy: Świat nanocząstek. PWN Warszawa 2016r.
2. K. Kurzydłowski, M. Lewandowska: Nanomateriały inżynierskie konstrukcyjne i funkcjonalne. PWN Warszawa 2010r.
3. R. Falcon: Handbook of Nanomaterials. Research Press New York 2015

Additional Literature

1. Baza Scopus: https://www.scopus.com/
2. Joseph H. Koo: Polymer nanocomposites Processing, Characterization and Application. The McGraw-Hill Companies 2016 ISBN 978-07-149204-1
3. Praca zbiorowa pod redakcją Vijay Kumar Thakur: Eco-Friendly Polymer Nanocomposites Processing and Properties. Springer 2016 ISBN 978-81-322-2470-9
4. Praca zbiorowa pod redakcją K. Zelechowskiej: Nanotechnologia w praktyce. PWN Warszawa 2016r.

5. Vikas Mittal: Modeling and Prediction of Polymer Nanocomposite Properties. Wiley-VCH 2013

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nch.IV
Item Name	**A block of subjects from the discipline of *chemical sciences* to choose from: MODERN TECHNIQUES OF QUALITATIVE AND QUANTITATIVE ANALYSIS IN GAS CHROMATOGRAPHY**
Course coordinator responsible for preparing the syllabus	dr inż. Łukasz Dąbrowski

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30***	dr inż. Łukasz Dąbrowski

*- subject taught separately in a group of disciplines

Lectures:
qualitative and quantitative analysis in gas chromatography: introduction and basic concepts, retention parameters in gas chromatography (retention time, relative retention time, retention index – RI et al.) and their application in qualitative analysis; use of specific detectors and multi-detector systems to confirm the results of the analysis; the use of a mass spectrometer as a detector allowing for the separation of co-eluting substances (methods of deconvolution of mass spectra); Quantitative analysis using different calibration methods

Laboratory exercises:
modern software for data acquisition and chromatogram processing for qualitative and quantitative analysis, use of available databases to determine the initial conditions for conducting chromatographic analysis and helpful in qualitative analysis (RI, MS); practical aspects of the application of software for deconvolution of mass spectra; chromatographic analysis of selected mixtures of compounds in order to obtain data that can be processed using previously known software and databases.

3. TEACHING METHODS

Lectures - 15 hours, laboratory classes - 15 hours.

Lectures (15 hours) - colloquium / laboratory classes (15 hours) - reports

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies

	a) to the extent that it is possible to revise the existing paradigms – the world body of work on gas chromatography, including theoretical foundations and general issues and selected specific issues (qualitative and quantitative analysis).
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) main trends in the development of the discipline of chemical sciences in the field of gas chromatography
P8S_WG_c	Context – conditions, effects c) methodology of chromatographic studies using gas chromatography
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in the field of gas chromatography
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex chromatographic problems (such as selectivity, sensitivity) or perform research tasks in the field of gas chromatography
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements in the discipline of chemical sciences

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Report	Academic Essay
P8S_WG_a			x		x	
P8S_WG_b			x		x	
P8S_WG_c			x		x	
P8S_WK_c			x		x	
P8S_UW_a			x		x	
P8S_KK_a			x		x	

6. LITERATURE

Basic Literature

1. Z. Witkiewicz, J. Kałużna-Czaplińska, Podstawy chromatografii i technik elektromigracyjnych, PWN, Warszawa 2017
2. Z. Witkiewicz, W. Wardencki, Chromatografia gazowa - teoria i praktyka, WN PWN Warszawa 2018
3. Chromacademy (www.chromacadey.com)

Additional Literature
1. P. Konieczka, J. Namieśnik (red). Ocena i kontrola jakości wyników pomiarów analitycznych, WNT, Warszawa 2014 2. H-J. Hubschmann, Handbook of GC/MS : fundamentals and applications, Wiley-VCH, Weinheim 2001

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nch. IX
Item Name	**A block of subjects from the discipline of *chemical sciences* to choose from:** **THIN-FILM SYSTEMS – PREPARATION AND PROPERTIES**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Łukasz Skowroński, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr hab. inż. Łukasz Skowroński, prof. PBŚ

*- subject taught separately in a group of disciplines

Lecture:
1. Thin-film systems – preliminary issues
2. Thin film growth models
3. Obtaining thin films (PVD and CVD)
4. Microstructure of thin-film systems
5. Mechanical Properties
6. Optical Properties
7. Catalytic properties
8. Sensory properties

Seminar:
During the seminar, PhD students present the issue of properties of selected materials.

3. TEACHING METHODS

Lecture - 10 hours, seminar - 5 hours.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – the world achievement, including theoretical foundations and general issues and selected specific issues specific to the chemical sciences
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) the main development trends of the discipline of chemical sciences
P8S_WG_c	Context – conditions, effects c) the methodology of scientific research of chemical sciences
P8S_WK_c	Context – conditions, effects

	c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in the field of chemical sciences
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks and draw conclusions on the basis of the results of research in the field of chemical sciences
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements in the field of chemical sciences

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a				x	x	
P8S_WG_b				x	x	
P8S_WG_c				x	x	
P8S_WK_a				x	x	
P8S_UW_a				x	x	
P8S_KK_a				x	x	

6. LITERATURE

Basic Literature
1. R.W. Kelsall, I.W. Hamley, M. Geoghegan: Nanotechnologie, Wydawnictwo Naukowe PWN, 2008. 2. A.Zawadzka, Cienkie warstwy i nanostruktury cienkowarstwowe – eksperymentalne metody wytwarzania i badania właściwości, Wydawnictwo Naukowe UMK, Toruń 2016
Additional Literature
1. K. Kurzydłowski, M. Lewandowska, Nanomateriały inżynierskie konstrukcyjne i funkcjonalne, Wydawnictwo Naukowe PWN, Warszawa 2021

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nch.V
Item Name	**Block of subjects from the discipline of *chemical sciences* *choose from:*** **MODERN TECHNIQUES COMBINED IN ANALYTICAL CHEMISTRY**
Course coordinator responsible for preparing the syllabus	dr hab. Przemysław Kosobucki, prof. PBŚ

1. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr hab. Przemysław Kosobucki, prof. PBŚ

*- subject taught separately in a group of disciplines

A brief historical outline of separation methods (chromatography, electromigration techniques), criteria for the selection of methods. Mechanisms and theory of chromatographic separation, discussion of stationary phases, retention parameters, separation factor, selectivity and resolution. Optimizing chromatographic separation: van Deemter equation, column efficiency. Construction of a gas chromatograph, including: discussion of injection devices (dispensers), chromatographic columns, detectors. Coupling of gas chromatography with mass spectrometry. Basic mass analyzers in GC MS and GC MS/MS systems. Dispensers, analytical and preparative columns, spectrophotometric, electrochemical and other specific detectors. Coupling of HPLC technique with mass spectrometry. ESI, TSI and other interfaces. Analyzers Chip LC MS. Sample injection methods in mass spectrometry, types of ionization (EI, CI, APCI, ESI, MALDI). Tandem and multiple mass spectrometry Multivariate and multivariate chromatography combined with mass spectrometry (GCxGC-ToFMS, LCxLC-MS). Other conjugated techniques (IC-MS). Mechanisms and theory of separation in electromigration techniques. Coupled electromigration techniques (CZE-MS, ITP-MS). Chip systems.

2. TEACHING METHODS

Lecture - 15 hours
Lecture (15 hours) with multimedia presentation, discussion.

3. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	The student has in-depth knowledge of separation methods, enabling them to conduct advanced research work

	related to the analysis of industrial and environmental samples. He knows the basics, as well as the structure and operation of a mass spectrometer.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) The student knows the directions of development of analytics and knows the principles of green analytical chemistry.
P8S_WG_c	The student has in-depth knowledge of the preparation of environmental and industrial samples for analysis and instrumental techniques of chromatographic and electromigration techniques coupled with a mass spectrometer, among others.
P8S_WK_c	The student knows and understands the essence of intellectual property protection, types of industrial property objects and the essence of copyright law, as well as selected institutions and organizations in the field of intellectual property protection in Poland, the EU and in the world
SKILLS: can	
P8S_UW_a	is able to select the technique of sample preparation and then the appropriate technique coupled for analysis, depending on their chemical nature and the matrix in which they occur
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	is aware of the need to constantly monitor legal regulations related to environmental protection

4. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a		x				
P8S_WG_b		x				
P8S_WG_c		x				
P8S_WK_c		x				
P8S_UW_a		x				
P8S_KK_a		x				

5. LITERATURE

Basic Literature

1. W. Szczepaniak, "Metody instrumentalne w analizie chemicznej", Wydawnictwo naukowe PWN, Warszawa, 2012.
2. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, "Podstawy chemii analitycznej 2", Wydawnictwo Naukowe PWN, Warszawa 2007
3. J. Kałużna-Czaplińska, Z. Witkiewicz, Podstawy chromatografii i technik elektromigracyjnych, PWN, Warszawa 2017.
4. R. Johnstone, M. Rose, "Spektrometria mas", PWN, Warszawa 2001.
5. P. Suder, J. Silberring, „Spektrometria mas", Wydawnictwo UJ, Kraków 2006.
6. A. Kraj, A. Drabik, J. Silberring, "Proteomika i metabolomika", Wydawnictwo UW, Warszawa 2010.

7. A. Hulanicki, „Współczesna chemia analityczna. Wybrane zagadnienia”, PWN, Warszawa 2001.
8. B. Buszewski, E. Dziubakiewicz, M. Szumski, „Techniki elektromigracyjne. Teoria i praktyka”, Malamut, Warszawa, 2012.

Additional Literature

1. Z. Witkiewicz, J. Hepter, „Chromatografia gazowa”, Wydawnictwo NT, Warszawa, 2009.
2. C.F. Poole, „The essence of chromatography”, Elsevier, Amsterdam, 2003.
3. A. Cygański, „Metody spektroskopowe w chemii analitycznej”, Wydawnictwo WNT, Warszawa, 2012.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nch.VI
Item Name	**A block of subjects from the discipline of *chemical sciences* to choose from:** **MODERN TRENDS IN THE ENERGY SECTOR – GREEN ENERGY**
Course coordinator responsible for preparing the syllabus	dr inż. Sylwia Kwiatkowska-Marks

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr inż. Sylwia Kwiatkowska-Marks
Energy sources. Renewable and non-renewable energy resources. Renewable Energy Sources in Poland and in the world. Green and blue hydrogen. Fuel cells. Geothermal energy. The energy of the sun. Photovoltaics. Aerothermal energy. Hydrothermal. The energy of sea currents, tides and waves. Biomass energy. Alternative energy sources. Energy management.		

3. TEACHING METHODS

Multimedia lecture - 15 hours. Multimedia lecture. Synchronous distance learning.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – the global achievement, including theoretical foundations and general issues and selected specific issues relevant to chemical and related sciences
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) main development trends in the energy sector of renewable energy sources
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies b) methodology of scientific research in the field of renewable energy sources
P8S_WK_c	Context – conditions, effects

	(c) the basic principles of knowledge transfer to the economic and social sphere and the commercialisation of the results of scientific activities and the know-how related to these results in the field of renewable energy;
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the field of modern trends in the energy sector
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements in the field of chemical and related sciences

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x			
P8S_WG_b			x			
P8S_WG_c			x		x	
P8S_WK_c			x			
P8S_UW_a			x		x	
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Jastrzębska G., Energia ze źródeł odnawialnych i jej wykorzystanie, Wydawnictwa Komunikacji i Łączności, Warszawa 2017
2. Klugmann-Radziemska E., Lewandowski W., Proekologiczne odnawialne źródła energii. Kompendium, Wydawnictwo Naukowe PWN, Warszawa 2017
3. Niedziółka D., Zielona energia w Polsce, CeDeWu, Warszawa 2012
4. Wolańczyk F, *Elektrownie wiatrowe*, KaBe, Krosno, 2009
5. Nowak W., Stachel A., Borsukiewicz-Gozdur A., *Zastosowania odnawialnych źródeł energii*, Wyd. Politechniki Szczecińskiej, Szczecin, 2008

Additional Literature

1. *Czasopisma branżowe, np. Polska Energetyka Słoneczna*, 2018

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nch. VII
Item Name	**Block of subjects from the discipline of *chemical sciences* choose from:** **PLASTICS TESTING TECHNIQUES**
Course coordinator responsible for preparing the syllabus	dr inż. Krzysztof Lewandowski dr inż. Katarzyna Skórczewska

1. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr inż. Krzysztof Lewandowski

*- subject taught separately in a group of disciplines

Influence of chemical structure on selected functional and processing properties of polymer plastics. The concept of polymer plastics. Identification test methods – quantitative and qualitative analysis of polymers. Principles for the determination of mechanical, thermal and processing properties of polymer plastics. Structure assessment. Standardization of tests. Advanced and modern measurement techniques. Design and implementation of a research program in terms of solving practical and scientific problems related to polymer plastics.

2. TEACHING METHODS

Lecture – 15 hours
Multimedia lecture, discussion.

3. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – the world achievement, including theoretical foundations and general issues and selected specific issues specific to the chemical sciences
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) the main development trends of the discipline of chemical sciences
P8S_WG_c	Context – conditions, effects c) the methodology of scientific research of chemical sciences
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in the field of chemical sciences
SKILLS: can	

P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks in the field of chemical sciences
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements in the field of chemical sciences

4. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			x		x	
P8S_WG_b			x		x	
P8S_WG_c			x		x	
P8S_WK_c			x		x	
P8S_UW_a			x		x	
P8S_KK_a			x		x	

5. LITERATURE

Basic Literature

1. Broniewski T., Kapko J., Płaczek W., Thomalla J.: Metody badań i ocena właściwości tworzyw sztucznych, WNT, Warszawa 2000
2. Grellmann W. (red), Seidler S. (red.): Polymer Testing, Hanser Publications; Monachium 2007
3. Brown R. (red.): Handbook of Polymer Testing - Short-Term Mechanical Tests, Rapra Technology Limited, Shawbury 2002
4. European and Polish standards: EN ISO 527, EN ISO 1133, EN ISO 179, EN ISO 306

Additional Literature

1. Karasiewicz T., Moraczewski K., Rytlewski P., Stepczyńska M., Żenkiewicz M.: Metody badań i oceny niektórych właściwości tworzyw polimerowych i metali, Wydawnictwo UKW, Bydgoszcz 2012
2. Przygocki W.: Metody fizyczne badań polimerów, PWN, Warszawa 1990
3. scopus.com

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nch. VIII
Item Name	**A block of subjects from the discipline of *chemical sciences* to choose from:** **MODERN EXPERIMENTAL TECHNIQUES**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Łukasz Skowroński, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15***	dr hab. inż. Łukasz Skowroński, prof. PBŚ

*- subject taught separately in a group of disciplines

Lecture:
The lecture presents modern experimental techniques in the study of materials and elements of the theory of physical phenomena used in them.
1. General characteristics of materials
2. Elements of solid state physics
3. Surface Topography Survey (AFM, SEM, STM, TEM, COM)
4. X-rays – structural studies of materials
5. Electron spectroscopy (XPS/UPS, AES)
6. IR spectroscopy, Raman scattering
7. Spectrophotometry, Ellipsometric Spectroscopy

Seminar:
During the seminar, PhD students present the issue of the application of a selected measurement technique in materials research.

3. TEACHING METHODS

Lecture - 10 hours, seminar - 5 hours.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – the world achievement, including theoretical foundations and general issues and selected specific issues specific to the chemical sciences
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) the main development trends of the discipline of chemical sciences
P8S_WG_c	Context – conditions, effects c) the methodology of scientific research of chemical sciences

P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results in the field of chemical sciences
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks and draw conclusions based on the results of scientific research in the field of chemical sciences
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of achievements in the field of chemical sciences

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a				x	x	
P8S_WG_b				x	x	
P8S_WG_c				x	x	
P8S_UW_a				x	x	
P8S_KK_a				x	x	

6. LITERATURE

Basic Literature

1. R.W. Kelsall, I.W. Hamley, M. Geoghegan: Nanotechnologie, Wydawnictwo Naukowe PWN, 2008.
2. W.Szczepaniak, Metody instrumentalne w analizie chemicznej, Wydawnictwo Naukowe PWN, 2007
3. C. Kittel, Wstęp do fizyki ciała stałego, Wydawnictwo Naukowe PWN, 1976.

Additional Literature

1. W.Zieliński, A.Rajca, Metody spektroskopowe i ich zastosowanie do identyfikacji związków organicznych, Wojciech Zieliński (red.), Andrzej Rajca (red.), Roman Mazurkiewicz, Warszawa: WNT, 2000
2. A.Zawadzka, Cienkie warstwy i nanostruktury cienkowarstwowe – eksperymentalne metody wytwarzania i badania właściwości, Wydawnictwo Naukowe UMK, Toruń 2016

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nozij.I
Item Name	**A block of subjects from the discipline of *management and quality studies* to choose from: SUSTAINABLE BUSINESS MANAGEMENT**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Małgorzata Gotowska prof. PBŚ.

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
	15h	dr hab. inż. Małgorzata Gotowska prof. PBŚ
Lecture 1: Business management in a turbulent environment. Lecture 2: The life cycle of an organization and the concept of sustainable development. Lectures 3 and 4: Implementing sustainable development in the processes of organizational functioning. Lecture 5 and 6: Turquoise organization management in the aspect of sustainable development. Lectures 7 and 8: Sustainable development and corporate social responsibility. Lecture 9: Sustainable development of the company as an element of employer branding. Lecture 10: Creating green competences of employees in a sustainable organization. Lecture 11 and 12: Work-life-balance as a modern concept of employee management. Lecture 13: Sustainable innovation in the organization. Lectures 14 and 15: Building and maintaining a sustainable organization in a rapidly changing environment.		

3. TEACHING METHODS

multimedia lecture, demonstration, discussion, lecture, case method
lecture (15 hours)

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Knows and understands to the extent that allows for the revision of existing paradigms – the world's achievements, including theoretical foundations as well as general issues and selected specific issues – appropriate for disciplines of management and quality sciences.
P8S_WG_b	Knows and understands the main development trends in the discipline of management and quality science.

P8S_WG_c	Knows and understands the methodology of scientific research specific to the science of management and quality.
P8S_WK_c	He knows and understands the basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity in the field of management and quality science.
SKILLS: can	
P8S_UW_a	He/she is able to use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks, and creatively apply and draw conclusions based on the results of scientific research.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	He is ready to critically evaluate the achievements within the discipline of management and quality science. He is ready to think in an entrepreneurial way.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a	x					
P8S_WG_b					x	
P8S_WG_c					x	
P8S_WK_c					x	
P8S_UW_a					x	
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Agnieszka Rzeńca, Dominik Drzazga, Małgorzata Burchard-Dziubińska, Zrównoważony rozwój - naturalny wybór. 2014, Wyd. Uniwersytetu Łódzkiego.
2. Wyzwania Zrównoważonego Rozwoju w Polsce (pr. zb., red. J. Kroneberg i T. Bergier). Wyd. Fundacja Sendzimira, Kraków 2010.
3. Piotr Trzepacz „Zrównoważony rozwój - wyzwania globalne" (2012); Podręcznik dla uczestników studiów doktoranckich, IGiGP UJ, Kraków - wybrane fragmenty.

Additional Literature

1. Kronenberg Jakub, Bergier Tomasz (red.) - Wyzwania zrównoważonego rozwoju w Polsce. Fundacja Sendzimira, 2010
2. Wskaźniki zrównoważonego rozwoju. Borys T. (red.) . Wyd. Ekonomia i Środowisko, 2005,ss. 348

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nozij.II
Item Name	**A block of subjects from the discipline of *management and quality studies* to choose from: MODERN TYPES OF LEADERSHIP**
Course coordinator responsible for preparing the syllabus	dr hab. Iwona Posadzińska, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. Iwona Posadzińska, prof. PBŚ
Leadership – origins, concepts, basic issues. Classic and modern models of leadership. Concepts and types of leadership. Qualities and tasks of a leader. Leader's personality. Situational models of leadership. Methods of personal development of a leader. Directions of changes in leadership styles in international business in the 21st century.		

3. TEACHING METHODS

Multimedia lecture, discussion

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Knows in-depth knowledge of the evolution of views on leadership and the change of paradigms of management sciences and quality in the field of leadership
P8S_WG_b	Knows the main development trends in the discipline of management and quality sciences
P8S_WG_c	Knows the methodology for identifying targeting styles
P8S_WK_c	He knows the basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity in the field of management and quality science.
SKILLS: can	
P8S_UW_a	Can use knowledge from various disciplines of social sciences to creatively solve managerial problems.
SOCIAL COMPETENCE: is ready to	

P8S_KK_a	They are prepared to critically evaluate their achievements within the discipline of management and quality sciences.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a	X					
P8S_WG_a					X	
P8S_WG_c	X					
P8S_WK_c					X	
P8S_UW_a	X					
P8S_KK_a	X					

6. LITERATURE

Basic Literature

1. Karaszewski R., Skrzypczyńska K., Przywództwo w biznesie, TNOiK, Toruń 2016
2. Blanchard K., Przywództwo wyższego stopnia. Blanchard o przywództwie i tworzeniu efektywnych organizacji, PWN, Warszawa 2021
3. Karaszewski R., Drewniak R., Skrzypczyńska K., Ewolucja stylów przywództwa, TNOiK, Toruń 2019

Additional Literature

1. Belker Loren B., Jim McCormick, Topchik Gary S., Początkujący menedżer, PWN, Warszawa 2023
2. Karaszewski R., Przywództwo w środowisku globalnego biznesu, TNOiK, Toruń 2008
3. Grint K., The Arts of Leadership, Oxford 2001

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nozij.III
Item Name	**A block of subjects from the discipline of *management and quality studies* to choose from: RESOURCE-PROCESS COST ACCOUNTING**
Course coordinator responsible for preparing the syllabus	dr hab. Arkadiusz Januszewski, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15W+15Design**	dr hab. Arkadiusz Januszewski, prof. PBŚ

Lecture:
Imperfections of traditional cost accounting. Premises for the creation and implementation of activity cost accounting. The essence of *Activity Based Costing (ABC)* and *Resource Cost Accounting (RCA).* Interpretation of the cumulative profit chart (the so-called whale curve). Characteristics of resources, activities and cost objects. Simple and complex RCA/ABC models. Cost flow network in ABC. Resource cost objects and activity cost objects. Evaluate the profitability of products, customers, and suppliers in the ABC of activity costs.
Methodologies for the design and implementation of resource and process cost accounting. Construction phases of the RCA/ABC system. RCA/ABC model structures. Define processes, activities, and cost objects. Defining the resource structure of your company and assigning costs to resources. Define flow paths. Principles of designing a contribution margin account using the OPC.
Project:
Independent development of a model of resource and process accounting of cost accounting for a selected company. Implementation of the developed model in the IT environment. Presentation and interpretation of results.

3. TEACHING METHODS

Multimedia lecture, case studies
Spreadsheet design method

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Understands the essence of profitability assessment using coverage margin accounts and resource-process cost accounting. Knows the stages and principles of designing a resource-process cost accounting system
P8S_WG_b	Knows and understands the main development trends in the discipline of management and quality science.

P8S_WG_c	Knows the methodology of scientific research specific to the science of management and quality.
P8S_WK_c	He knows the basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity in the field of management and quality science.
SKILLS: can	
P8S_UW_a	Can design a resource and process cost accounting system for a micro, small or medium-sized enterprise
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	He is ready to cooperate in the design of a resource and process cost accounting system. Can identify and resolve decision-making problems using their knowledge and acquired skills.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a		x				
P8S_WG_b					x	
P8S_WG_c					x	
P8S_WK_c					x	
P8S_UW_a				x		
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Zieliński T. Zasobowo-procesowy rachunek kosztów (ZPRK/RPCA). Akademia Controllingu. Poznań, 2017
2. Miller J. Zarządzanie kosztami działań. Wig-Press. Warszawa 2000
3. Piechota R. Projektowanie rachunku kosztów działań. Difin 2005

Additional Literature

1. Kaplan R.S, Anderson S.R. Rachunek kosztów działań sterowany czasem. Wydawnictwo Naukowe PWN, Warszawa 2008
2. Cokins, G. Activity-Based Cost Management. An Executive's Guide. John Wiley & Sons, Inc., New York, 2001
3. Miesięcznik Controlling i Rachunkowość Zarządcza – artykuły o rachunku kosztów działań.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nozij.IV
Item Name	**A block of subjects from the discipline of *management and quality studies* to choose from: BUSINESS ETHICS**
Course coordinator responsible for preparing the syllabus	dr hab. Grażyna Voss prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. Grażyna Voss prof. PBŚ

1) Business ethics as an element of the functioning of business units.
2) Building relationships between the company and its customers, business partners, employees and competitors.
3) Business ethics and economic analysis.
4) Codes of professional ethics and responsibility for actions taken.
5) Factors that determine the ethics of the company (external and internal).
6) Ethical decision-making and the company's mission, its policy, organizational culture, and employee morality.
7) Core values of business ethics.
8) Non-financial reporting and goodwill.
9) Unethical behaviour – causes and effects.
10) Profit and ethics in business.

3. TEACHING METHODS

Lecture, discussion, case study,

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	He knows and understands the world's achievements, including the theoretical foundations of business ethics. Knows and understands the ethical determinants of business and the determinants of business activity and the essence of scientific research
P8S_WG_b	Knows and understands the main development trends in the discipline of management and quality science.
P8S_WG_c	Knows the methodology of scientific research specific to the science of management and quality.

P8S_WK_c	He knows the basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity in the field of management and quality science.
SKILLS: can	
P8S_UW_a	Is able to critically analyze and evaluate the results of scientific research in the context of ethical behavior in business.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	It conducts scientific and research activities in an independent manner and in accordance with business ethics. He is ready to critically evaluate his achievements within the framework of business ethics.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a					x	
P8S_WG_b					x	
P8S_WG_c					x	
P8S_WK_c					x	
P8S_UW_a						x
P8S_KK_a					x	x

6. LITERATURE

Basic Literature

1. Etyka biznesu, Peale Norman Vincent Blanchard Kenneth, Studio EMKA,
2. Etyka biznesu i społeczna odpowiedzialność biznesu - Arasu R, KS OmniScriptum Publishing

Additional Literature

1. Codes of Professional Ethics (in Accounting, for Auditors)

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nozij.V
Item Name	**A block of courses from the discipline of *management and quality studies* to choose from: BUSINESS RELATIONSHIP MANAGEMENT**
Course coordinator responsible for preparing the syllabus	dr Urszula Słupska

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr Urszula Słupska

Lecture:
1. The essence and components of relational capital
2. Relational Capital Measurement and Relationship Management
3. Building intra-organizational relationships
4. Building relationships with the environment
5. Network relationships in business
6. Virtual relationships in business

Case studies:
During the classes, doctoral students present aspects of building relationships in the organization of their choice.

3. TEACHING METHODS

Multimedia and informational lecture conducted by the method of explaining issues and discussion. Case studies in the field of issues presented during the lecture.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) The doctoral student knows the theoretical foundations and selected specific aspects specific to the science of management and quality; In particular, he knows and understands the essence and importance of relationship management in business.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) The PhD student knows and understands the main development tendencies in the discipline of management and quality science, in particular regarding relationship building in the modern business world.
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) The doctoral student is familiar with the research methodology specific to management and quality science, used to study relational capital.

P8S_WK_c	Context – conditions, effects c) A PhD student understands the role of relational capital in building a competitive advantage. He knows the basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity in the field of management and quality science.
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) A PhD student is able to use the acquired knowledge to creatively identify and solve problems related to relationship management in organizations.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) A doctoral student is ready to critically evaluate the achievements within the framework of management and quality science, in particular aspects of building business relationships. Can analyze different approaches to relationship management in business and choose the right ones.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a				x	x	
P8S_WG_b				x	x	
P8S_WG_c				x	x	
P8S_WK_c				x	x	
P8S_UW_a				x	x	
P8S_KK_a				x	x	

6. LITERATURE

Basic Literature

1. Karaszewski R., Posadzińska I., Drewniak R., Drewniak Z., Słupska U. (2020), *Kapitał relacyjny w biznesie*, Wydawnictwa Uczelniane UTP, Bydgoszcz.
2. Chomiak-Orsa I. (2016), *Zarządzanie relacjami w organizacjach sieciowych*, „Zeszyty Naukowe Politechniki Śląskiej; Organizacja i Zarządzanie", z.90, nr 1953.

Additional Literature

1. Danielak W. (2012), *Kształtowanie kapitału relacyjnego w małym i średnim przedsiębiorstwie*, Wydawnictwo Uniwersytetu Ekonomicznego, Wrocław.
2. Zakrzewska-Bielawska A. (2016), *Potencjał relacyjny a innowacyjność przedsiębiorstwa – w kierunku open innovation,* „Management Forum", Vol. 4(1), s. 3-10.
3. García-Merino J.D., García-Zambrano L., Rodriguez-Castellanos A. (2014), *Impact of Relational Capital on Business Value*, "Journal of Information & Knowledge Management", Vol. 13(1).

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nozij.VI
Item Name	**A block of subjects from the discipline of *management and quality studies* to choose from:** **SOCIAL, ECONOMIC AND ERGONOMIC ASPECTS OF HUMAN RESOURCES MANAGEMENT**
Course coordinator responsible for preparing the syllabus	dr inż. Agnieszka Goździewska-Nowicka

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr inż. Agnieszka Goździewska-Nowicka

1. Professional development and the concept of WLB (meaning and forms of professional development. Effectiveness and costs of professional development. Professional development of managers and leaders. Self-management.
2. Challenges and strategies of human resources management (challenges related to globalization and European integration. Strategic HRM).
3. Preparation of professional and competency models of managers.
4. Introduction to the issues of stress and burnout (work and career as a source of stress, job satisfaction, organizational and non-organizational stressors, stress in managerial positions).
5. Ergonomics as a modern comprehensive and empirical science (origin and name of ergonomics, definition, subject and scope of ergonomics).
6. A new paradigm in ergonomics (zones of influence of ergonomics, subject of ergonomic research).
7. Optimisation of the working space (optimisation ranges; optimal working position; principles of ergonomics of the hand working space; optimisation of the visual space; optimisation of the height of the working surface in sitting and standing positions; working rooms, lighting and ventilation conditions, dangerous, harmful and burdensome factors).

3. TEACHING METHODS

Lecture – 15 hours;
Multimedia presentation combined with discussion, training videos, business game

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	to the extent that allows for the revision of existing paradigms – the world achievement, including theoretical foundations and general issues and selected specific issues – specific to a given scientific or artistic discipline

P8S_WG_b	main development trends in the scientific or artistic disciplines in which education takes place
P8S_WG_c	research methodology
P8S_WK_c	basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results
SKILLS: can	
P8S_UW_a	use knowledge from various fields of science or the field of art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, and in particular: define the purpose and object of scientific research, formulate a research hypothesis, develop research methods, techniques and tools and creatively apply them, draw conclusions based on the results of scientific research
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	critical evaluation of achievements within a given scientific or artistic discipline

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			X			
P8S_WG_b			X			
P8S_WG_c			X			
P8S_WK_c			X			
P8S_UW_a					X	
P8S_KK_a					X	

6. LITERATURE

Basic Literature

1. Pujer K., Ekonomiczne i społeczne aspekty nowoczesnego zarządzania przedsiębiorstwem, Exante, Wrocław 2016.
2. Wykowska M.,Ergonomia, Wyd. AGH, Kraków, 2014.
3. Kordecka D., Bezpieczeństwo pracy i ergonomia, Wyd. CIOP, Warszawa, 2007.
4. Olszewski J., Podstawy ergonomii i fizjologii pracy, Wyd. AE w Poznaniu, Poznań, 2018.

Additional Literature

1. Bugajska J. [i in.], Ergonomia, Centralny Instytut Ochrony Pracy, Warszawa 2012.
2. Mikulski R., Bezpieczeństwo i ochrona człowieka w środowisku pracy, Centralny Instytut Ochrony Pracy, Warszawa 2019.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.nozij.VII
Item Name	**A block of courses from the discipline of *management and quality studies* to choose from: USE OF MODERN TECHNOLOGIES IN MANAGEMENT PROCESSES**
Course coordinator responsible for preparing the syllabus	dr Paweł Modrzyński

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr Paweł Modrzyński

The aim of the course is to familiarize doctoral school students with the latest trends and technologies used in the field of management. The course aims to develop the ability to analyze, evaluate and apply modern technologies in various areas of management, including strategic management, operational management, human resource management and innovation management.
Program contents:

1. Introduction to modern technologies in management
- Definition and importance of modern technologies in management
- An overview of the latest technology trends in the field of management
- The impact of modern technologies on business processes
2. Information technology in management
- Management support IT systems (ERP, CRM, SCM)
- Using data analytics and big data in decision-making
- Cloud computing and its importance for management
3. Communication technology and team collaboration
- Online communication and collaboration tools
- The use of social media in management
- Virtual teams and their management
4. Mobile technologies and their role in management
- Mobile applications supporting management
- Leveraging mobility in business process management
- Data security and risk management in the context of mobility
5. Internet of Things (IoT) technologies in management
- The use of IoT in the monitoring and optimization of production processes
- Smart buildings and energy management
- Harnessing IoT data to drive business decisions
6. Artificial Intelligence (AI) and Automation Technologies
- Applying AI to Planning and Optimization
- Automate business processes with AI tools
- Ethical and social aspects related to the use of AI in management
7. Blockchain technologies and their importance for governance
- Principles of blockchain technology

- Using blockchain in supply chain management
- Data security and identification in the context of blockchain technology

8. Implementation of modern technologies in the organization

- The process of implementing new technologies in the company
- Change management in the context of the introduction of modern technologies
- Measuring the effectiveness and evaluating the effectiveness of the use of new technologies

3. TEACHING METHODS

Multimedia lecture carried out in a stationary form and/or with the use of available tools and platforms for distance learning.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	He knows in-depth terminology in the field of management and the use of modern technologies in management processes.
P8S_WG_b	Knows and understands the main development trends in the discipline of management and quality science.
P8S_WG_c	Knows the methodology of scientific research specific to the science of management and quality.
P8S_WK_c	He knows the basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results.
SKILLS: can	
P8S_UW_a	Can use management knowledge to creatively identify, formulating and innovative solution of complex managerial problems.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	They are ready to critically evaluate their achievements within the discipline of management and quality science

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a		X				
P8S_WG_b					X	
P8S_WG_c					X	
P8S_WK_c		X				
P8S_UW_a		X				
P8S_KK_a		X				

6. LITERATURE

Basic Literature
1. Oliver Laasch, Principles of Management: Practicing Ethics, Responsibility, Sustainability, 2nd Edition, SAGE, Washington DC, 2021 2. Peter F. Drucker, Management: Tasks, Responsibilities, Practices, Harper Business, New York, Paperback – April 14, 1993 3. Fred R. David and Forest R. David IE, Strategic Management: A Competitive Advantage Approach, Concepts and Cases (16th Edition), Pearson Education, 2017
Additional Literature
1. Thomas M. Siebel, Digital Transformation: Survive and Thrive in an Era of Mass Extinction, Rosetta Books, New York 2019 2. Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st Edition, Apress, Frankfurt am Main, 2017 3. David L. Poole, Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, 2nd Edition, Cambridge University Press, 2017

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.rio.I
Item Name	**A block of subjects from the discipline of *agriculture and horticulture* to choose from:** **AGRONOMY**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Robert Lamparski, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30**	dr hab. inż. Karol Kotwica, prof. PBŚ dr hab. inż. Roman Rolbiecki, prof. PBŚ prof. dr hab. inż. Jacek Żarski prof. dr hab. inż. Dariusz Piesik dr hab. inż. Robert Lamparski, prof. PBŚ dr hab. inż. Grzegorz Lemańczyk, prof. PBŚ prof. dr hab. inż. Anna Wenda-Piesik dr hab. inż. Wojciech Kozera, prof. PBŚ dr hab. inż. Jarosław Poberężny, prof. PBŚ

1. "Environmental conditions of crop production in Poland" – including differences and references of national conditions to the conditions of EU countries) – Karol Kotwica, PhD, DSc, Eng., prof. PBŚ – 2 hours
2. "Crop production in the context of climate and energy policy" – including possible agrotechnical practices to reduce GHC emissions in crop production – Karol Kotwica, PhD, DSc, Eng., prof. PBŚ – 2 hours.
3. "Review of modern tillage systems" – including conditions, limitations, environmental and production effects – Karol Kotwica, PhD, DSc, Eng., prof. PBŚ – 2 hours
4. "Rotation as a basic element of good agricultural practice" – including the environmental and production adverse effects of simplifying rotations and agrotechnical ways of reducing them – Karol Kotwica, PhD, DSc, Eng., prof. PBŚ – 2 hours
5. "Environmental, production and economic aspects of biomass use" – including agrotechnical management of post-harvest residues (including straw), biomass of catch crops, natural fertilizers – Karol Kotwica, PhD, DSc, Eng., prof. PBŚ – 2 hours.
6. "Modern crop irrigation systems in agriculture and horticulture" – Roman Rolbiecki, PhD, DSc, Eng., prof. PBŚ – 2 hours
7. "Observed and predicted climate change and its consequences for agriculture" – Prof. Jacek Żarski, PhD, DSc, Eng. – 2 hours
8. "Climate threats to agriculture and mitigation systems" – Prof. Jacek Żarski, PhD, DSc, Eng. – 2 hours
9. "Volatile organic compounds and phytoegdysteroids in the context of the double defense system of plants" – Prof. Dariusz Piesik, PhD, DSc, Eng. – 2 hours
10. "Entomofauna in the ecological system of plant cultivation" – Robert Lamparski, PhD, DSc, Eng., prof. PBŚ – 2 hours
11. "Environmentally friendly plant protection" – Grzegorz Lemańczyk, PhD, DSc, Eng., prof. PBŚ – 2 hours

12. "Fungal threats to humans and animals and methods of mitigating their effects" – Grzegorz Lemańczyk, PhD, DSc, Eng., prof. PBŚ – 2 hours
13. "The problem with weed resistance to herbicides – ways to counteract this phenomenon" – Prof. Anna Wenda-Piesik, PhD, DSc, Eng. – 2 hours
14. "Fertilization and the biological value of cereal grains" – Wojciech Kozera, PhD, DSc, Eng., prof. PBŚ – 2 hours
15. "Commodity science and storage of plant products" – including storage conditions, modern methods of storage of raw materials and food products, quality assessment of goods and products of plant origin, nutritional value and anti-nutritional components in raw materials and food products – Jarosław Poberężny, PhD, DSc, Eng., prof. PBŚ – 2 hours

3. TEACHING METHODS

Lectures - 30 hours

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that allows for the revision of existing paradigms – to an expert degree evaluates the agronomic research achievements related to the discipline of agriculture and horticulture described in the world literature
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) the most important directions of agricultural research
P8S_WG_c	Context – conditions, effects (c) the methodology of the agronomic research
P8S_WK_c	Context – conditions, effects c) the possibility of using the results of scientific research in agricultural production,
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use all information in the field of agronomy based on the latest scientific achievements in order to solve their own research problems typical of the discipline of agriculture and horticulture
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) substantive analysis of achievements within the discipline of agriculture and horticulture

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a					x	
P8S_WG_b					x	

P8S_WG_c					x	
P8S_WK_c					x	
P8S_UW_a					x	
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Kopiński J., 2018. Assessment of Organizational and Production Changes in Polish Agriculture in the Context of Selected Environmental Impacts. ZN SGGW, tom 18, z. 4, 284–29.
2. Kopiński J., 2015. Agri-environmental effects of changes in agricultural production in Poland. Ecreg Studies, Vol. 8, No. 3, 5-18.
3. Borek R., Faber A., Jarosz Z., 2017. Redukcja emisji gazów cieplarnianych i amoniaku oraz metody adaptacji do zmian klimatu. Studia i Raporty IUNG-PIB, 52(6), 140ss.
4. Wrzaszcz W., Prandecki K., 2020. Rolnictwo a europejski zielony ład. Problems of Agricultural Economics, 4(365), 156-179.
5. Jaskulski D., Jaskulska I., 2016. Współczesne sposoby i systemy uprawy roli w teorii i praktyce rolniczej. CDR Brwinów o. Poznań, 30ss.
6. Kotwica K., Boruta-Breza B., Bauza-Kaszewska J., Kanarek P., Jaskulska I., Jaskulski D. 2021. The Cumulative Effect of Various Tillage Systems and Stubble Management on the Biological and Chemical Properties of Soil in Winter Wheat Monoculture. Agronomy 11, 1726.
7. Rechcigl M., 2018. CRC Handbook of Agricultural Productivity Volume I Plant Productivity. CRC Press
8. Taylor & Francis Croup Boca Raton London New York, 81ss
9. Doroszewska T., Harasim A., Kopiński J., Kuś J., Laskowska D., Matyka M., Skomra U., Smagacz J., 2015. Wybrane problemy produkcji rolniczej z uwzględnieniem aspektu dóbr publicznych. Studia i Raporty IUNG-PIB, 43(17), 156ss.
10. T5 Kotwica K., Boruta-Breza B., Bauza-Kaszewska J., Kanarek P., Jaskulska I., Jaskulski D. 2021. The Cumulative Effect of Various Tillage Systems and Stubble Management on the Biological and Chemical Properties of Soil in Winter Wheat Monoculture. Agronomy 11, 1726.
11. Barbara Breza-Boruta 1, Karol Kotwica 2 and Justyna Bauza-Kaszewska. 2021. Effect of Tillage System and Organic Matter Management Interactions on Soil Chemical Properties and Biological Activity in a Spring Wheat Short-Time Cultivation. Energies 14, 7451.
12. Nowak L., Karczmarczyk S. (red.). Nawadnianie roślin. 2006. Monografia, PWRiL Poznań. 1-479.
13. Rolbiecki R. 2021. Nawadniać czy nie nawadniać, dylematy współczesnego rolnictwa. [W:] Współczesne uwarunkowania i wyzwania gospodarowania wodą w rolniczej przestrzeni produkcyjnej Wielkopolski. 2021. Monografia, Bykowski J. (red.) Wyd. UP Poznań. 59-69.
14. Rolbiecki R. 2021. Ciśnieniowe systemy nawadniające w uprawach polowych. [W:] Współczesne uwarunkowania i wyzwania gospodarowania wodą w rolniczej przestrzeni produkcyjnej Wielkopolski. 2021. Monografia, Bykowski J. (red.) Wyd. UP Poznań. 71-83.
15. Żarski J., 2012. Tendencje zmian agroklimatu rejonu Bydgoszczy w latach 1981-2010. W: Bieliński M. (red.) Bydgoskie Kolokwium Wiedzy o Ziemi 2002-2012. BTN Bydgoszcz, 85-103.
16. Kuśmierek-Tomaszewska R., Żarski J. 2021. Assessment of meteorological and agricultural droughts occurrence in central Poland in 1961–2020 as an element of the climatic risk to crop production. Agriculture, 11, 855.

17. Kuśmierek-Tomaszewska R., Żarski J. 2021. The Effects of Plant Irrigation in Poland. In: Zeleňáková M., Kubiak-Wójcicka K., Negm A.M. (eds) Management of Water Resources in Poland. Springer Water. Springer, Cham, p. 379-393.
18. Chojnacka A. 2015. Lotne Związki Organiczne (LZO) : źródła emisji i metody ich usuwania. Poznań, Młodzi Naukowcy Jędrzej Nyćkowiak, 32-38.
19. Thiem B., Kikowska B., Maliński M. P., Kruszka D., Napierała M., Florek E. 2017. Ecdysteroids: production in plant in vitro cultures. Phytochem. Rev. 16 (4), 603-622.
20. Lamparski R., Kotwica K., Modnicki D., Balcerek M., Koim-Puchowska B. 2021. The effect of pro-ecological procedures and plant injury on the content of free phenolic acids in winter wheat and on the feeding and development of *Oulema melanopus*. Arthropod-Plant Interactions 15:937–947.
21. Pruszyński S. 2016. Metody ochrony w integrowanej ochronie roślin. Centrum Doradztwa Rolniczego w Brwinowie, Oddział w Poznaniu, 150ss.
22. Lemańczyk G., Łukanowski A., Baturo-Cieśniewska A. 2021. Poszukiwanie źródeł odporności owsa (Avena sativa L.) na nowy patogeniczny i mykotoksynotwórczy gatunek – Fusarium langsethiae. Biuletyn Instytutu Hodowli i Aklimatyzacji Roślin 295: 203–207.
23. Wenda-Piesik A., Lemańczyk G., Pańka D., Piesik D. 2016. Risk assessment posed by diseases in context of integrated management of wheat. Journal of Plant Diseases and Protection 123 (1): 3–18.
24. Żukiewicz-Sobczak W., Sobczak P., Imbor K., Krasowska E., Horoch A., Wojtyła A., Piątek J. 2012. Zagrożenia grzybowe w budynkach i w mieszkaniach – wpływ na organizm człowieka. Med. Og. Nauk Zdr. 18(2): 141–146.
25. Wenda-Piesik A., Lemańczyk G., Twarużek M., Błajet-Kosicka A., Kazek M., Grajewski J. 2017. Fusarium head blight incidence and detection of Fusarium toxins in wheat in relation to agronomic factors. European Journal of Plant Pathology 149 (3): 515–531.
26. Stankiewicz-Kosyl M., Synowiec A., Haliniarz M., Wenda-Piesik A., Domaradzki K., Parylak D., Wrochna M., Pytlarz E., Gala-Czekaj D., Marczewska-Kolasa K., Marcinkowska K., Praczyk T. 2020. Herbicide Resistance and Management Options of *Papaver rhoeas* L. and *Centaurea cyanus* L. in Europe: A Review. Agronomy, 10, 874.
27. Kączkowski J., 2004. Skład chemiczny ziarna pszenicy [w]: Pszenica chemia i technologia. Red. H. Gąsiorowski. PWRiL, Poznań, 151–173.
28. Gąsiorowski H., 2004. Składniki mineralne [w]: Pszenica chemia i technologia. Red. H. Gąsiorowski. PWRiL, Poznań, 204–208.
29. Świderski F., Waszkiewicz-Robak B., 2010. Towaroznawstwo żywności przetworzonej z elementami technologii. Wyd. SGGW, Warszawa, 616ss.
30. Pachołek B., Zmudziński W., Podsiadłowska J., 2015. Towaroznawstwo żywności. Wyd. UE Poznań, 138ss.
31. Flaczyk E., 2011. Towaroznawstwo żywności pochodzenia roślinnego. Wyd. UP Poznań, 398ss .

Additional Literature

1. Zegar J. S., 2021. Kwestia długookresowej strategii zrównoważonego rozwoju rolnictwa w Polsce. Problems of Agricultural Economics, 2(367), 16-30.
2. Pawlak J., 2018. Ocena ekonomicznych skutków redukcji emisji gazów cieplarnianych na przykładzie gospodarstw specjalizujących się w uprawach polowych. Problems of Agricultural Economics, 1(354) 2018, 170-191.
3. Bujanowicz-Hałas B., 2018. Emisja gazów cieplarnianych (GHG) z perspektywy polskiego sektora rolnego Roczniki Naukowe XX (3), 16-21.

4. Długosz J., Piotrowska-Długosz A., Kotwica K., Przybyszewska E., 2020. Application of Multi-Component Conditioner with Clinoptilolite and Ascophyllum nodosum Extract for Improving Soil Properties and Zea Mays L. Growth and Yield. Agronomy 10, 2005.
5. Pikuła D., 2019. Praktyki zapobiegające stratom węgla organicznego z gleby. Studia i Raporty IUNG-PIB, 59(13), 77-91.
6. Samuel I. Haruna , Nsalambi V. Nkongolo, 2019. Tillage, Cover Crop and Crop Rotation Efects on Selected Soil Chemical Properties. Sustainability 11, 2770.
7. Kotwica K., Jaskulska I., Gałęzewski L., Jaskulski D., Lamparski R., 2014. Spring wheat yield in short-term monoculture depending on the tillage method, use of organic matter and a biostimulant. Acta Sci. Pol., Agricultura 13(3) 2014, 19-28.
8. Kotwica K., Jaskulska I., Gałęzewski L., Jaskulski D., Lamparski R., 2014. The effect of tillage and management of post-harvest residues and biostymulant application on the yield of winter wheat in increasing monoculture. Acta Sci. Pol., Agricultura 13(4) 2014, 65-76.
9. Kaniszewski S., 2005. Nawadnianie warzyw polowych. PlantPress Kraków. 3-85.
10. Dzieżyc J., 1989. Rolnictwo w warunkach nawadniania. PWRiL, Warszawa. 1-415.
11. Żarski J., Dudek S., Kuśmierek-Tomaszewska R., Żarski W., 2017. Effects of agricultural droughts in the province of Kujawsko-Pomorskie and possibilities of minimizing their impact. Infrastructure and Ecology of Rural Areas, no. II/2/2017, s. 813-824
12. Kuśmierek-Tomaszewska R., Dudek S., Żarski J., Januszewska-Klapa K. 2018. Temporal variability of drought in field crops in the Region of Kujawsko-Pomorskie, Poland. Research for Rural Development, vol. 2, 62-68, DOI: 10.22616/rrd.24.2018.052.
13. Żarski J., Łaszyca E. 2019. Zmienność temperatury powietrza w latach 1971-2010 na podstawie pomiarów prowadzonych na stacji Bydgoszcz-Lotnisko. Rozdział w monografii 60-lecie Bydgoskiego Towarzystwa Naukowego (1959-2019), Wydawnictwo Uczelniane UTP Bydgoszcz, s. 264-278.
14. Piesik D., Bocianowski J., Sendel S., Krawczyk K., Kotwica K. 2020. Beetle orientation responses of Gastrophysa viridula and Gastrophysa polygoni (Coleoptera: Chrysomelidae) to a blend of synthetic volatile organic compounds. Environ. Entomol. 49(5): 1071–1076.
15. Piesik D., Rochat D., Delaney K.J., Marion-Poll F. 2013. Orientation of European corn borer first instar larvae to synthetic green leaf volatiles. J. Appl. Entomol. 137: 234–240.
16. Lemanowicz J., Bartkowiak A., Lamparski R., Wojewódzki P., Pobereżny J., Wszelaczyńska E., Szczepanek M. 2020. Physicochemical and enzymatic soil properties influenced by cropping of primary wheat (*Triticum sphaerococcum* and *Triticum persicum*) under organic and conventional farming systems. Agronomy, 10, 1652.
17. Pogăcean M.O., Gavrilescu M. 2009. Plant protection products and their sustainable and environmentally friendly use. Environmental Engineering and Management Journal 8(3): 607-627.
18. Zyska B. 1999. Zagrożenia biologiczne w budynku. Arkady, Warszawa.
19. Singh R., Sharma S. 2016. Mushroom poisoning: from toxicity to forensic analysis. Journal of the Indian Society of Toxicology 12(1): 43-47.
20. Grzebisz W., 2015. Nawożenie roślin uprawnych. PWRiL, W-wa, 1, 428ss.
21. Cichoń Z., 2009. Towaroznawstwo żywności : podstawowe metody analityczne. Wyd. UE Kraków.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.rio.II
Item Name	**A block of subjects from the discipline of *agriculture and horticulture* to choose from: BIOGEOCHEMISTRY**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Bożena Dębska

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30**	prof. dr hab. inż. Bożena Dębska; dr hab. inż Joanna Lemanowicz, prof. PBŚ; dr hab.inż Aneta Siwik-Ziomek, prof. PBŚ; dr hab.inż Barbara Breza-Boruta, prof. PBŚ, dr hab.inż Wojciech Kozera, prof. PBŚ; dr hab.inż Agata Bartkowiak, prof. PBŚ; prof. dr hab. inż. Mirosław Kobierski

Phosphorus and enzymes involved in the transformation of this element. The relationship between enzymatic activity and soil fertility. Sulphur as the fourth basic fertilizer component in plant cultivation. Sulphur and enzymes involved in the transformation of this element in the soil. Aluminum, a potential poison of the agrosystem – myth or truth? Selected trace elements in the geo- and biosphere (their division, occurrence in soil and plant, interactions with other elements, soil contamination with these elements). Soil degradation processes. Buffer properties of soils and their ecological importance. Clay minerals in environmental protection. Organic matter in soils – sources, transformations, qualitative composition, properties, with particular emphasis on the properties of humic and fulvic acids. Ecological role of humic substances in the environment. Biodiversity of microorganisms in the soil environment and their participation in the metabolism of organic matter.

3. TEACHING METHODS

Lecture – 30 hours
Classes are held in the form of a lecture

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) assesses the biogeochemical research achievements related to the discipline of agriculture and horticulture described in the world literature to an expert degree
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies

	(b) main trends in soil-plant relationships
P8S_WG_c	Context – conditions, effects c) selected aspects of scientific research methodology for the discipline of agriculture and horticulture
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer in the field of soil biology and chemistry to agricultural production
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge in the field of biogeochemistry to creatively identify, formulate and innovatively solve complex problems and perform research tasks in the discipline of agriculture and horticulture
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of scientific achievements within the discipline of agriculture and horticulture

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a					x	
P8S_WG_b					x	
P8S_WG_c					x	
P8S_WK_c					x	
P8S_UW_a					x	
P8S_KK_a					x	

6. LITERATURE

Basic Literature

1. Mikrobiologia i biochemia gleb, autor: Red. A. Paul, Francis E. Clark. Wydawnictwo UMCS Lublin, 2001.
2. Siarka w glebach Polski: stan i zagrożenie. T. Motowicka-Terelak, H. Terelak. Państwowa Inspekcja Ochrony Środowiska, 1998.
3. Minerały ilaste. L. Stoch. Wydawnictwo Geologiczne1988.
4. Potrzeby nawożenia roślin uprawnych siarką oraz metody ich wyznaczania. W. Szulc, Wyd. SGGW Warszawa, 2008.
5. Glin – występowanie w przyrodzie oraz wpływ na organizmy roślin, zwierząt i człowieka. K. Gromysz-Kałkowska, E. Szubartowska, UMCS, Lublin 1999.
6. Pierwiastki śladowe w geo- i biosferze. A. Kabata-Pendias, B. Szteke. Wydawnictwo IUNG-PIB, Puławy, 2012.
7. Fosfatazy w środowisku glebowym. E.J. Bielińska, A. Mocek-Płóciniak, Wydawnictwo UP, Poznań, 2009.
8. Pierwiastki w środowisku, Fosfor, 8(3). Red. W. Grzebisz. Wydawnictwo UWM, Olsztyn, 2003.
9. Ochrona gleb i rekultywacja terenów zdegradowanych. A. Karczewska A. UP Wrocław , 2017.

10. Badania ekologiczno-gleboznawcze. R. Bednarek, H. Dziadowiec, U. Pokojska, Z. Prusinkiewicz. PWN Warszawa, 2004.

Additional Literature

1. Życie bakterii. W. J. H. Kunicki-Goldfinger. Wydawnictwo Naukowe PWN, Warszawa, 2005.
2. Sulphur in crop production. H. W. Scherer. European Journal of Agronomy, 14(2), 81-111, 2001.
3. Adsorpcja i adsorbenty. Teoria i zastosowanie. Z. Sarbak. Wydawnictwo Naukowe UAM 2000.
4. Aktualne problemy gospodarowania siarką w rolnictwie polskim. W. Grzebisz, K Przygocka-Cyna. W: Zbilansowane nawożenie rzepaku. W. Grzebisz (red.), AR Poznań, 64-77, 2000.
5. Glin w otoczeniu i jego wpływ na organizmy żywe. J. Zuziak, M. Jakubowska M. Analit 2, 110–120, 2016.
6. Trace Elements in Soils and Plants. A. Kabata-Pendias. 4th ed. CRC Press, Taylor & Francis Group, Boca Raton, 2011.
7. Soil enzymes as bioindicators of soil ecosystem status. E.B. Utobo and L. Tewari. Applied ecology and environmental research 13.1, 147-169, 2015.
8. Ochrona i rekultywacja środowiska. F. Maciak. Wydawnictwo SGGW, 2003.
9. Podstawowe metody laboratoryjnej analizy gleby. E. Tyszkiewicz, R. Czubaszek, S. Roj-Rojewski Wydawnictwo: Politechnika Białostocka, 2019.
10. Humic Substances and Chemical Contaminants. Red: C.E. Clapp, M.H.B. Hayes, N. Senesi, P.R. Bloom, P.M. Jardine. SSCA, Medison, USA, 2001.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.rio.III
Item Name	**A block of subjects from the discipline of *agriculture and horticulture* to choose from: AGRICULTURAL BIOTECHNOLOGY**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Krzysztof Gęsiński, prof. PBŚ

2. DIVISION INTO SEMESTERS, NUMBER OF HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30**	dr hab. inż. Krzysztof Gęsiński, prof. PBŚ, dr hab. inż. Anna Baturo-Cieśniewska, dr hab. inż. Grzegorz Lemańczyk, prof. PBŚ, dr hab. inż. Dariusz Pańka , prof. PBŚ, prof. dr hab. inż. Elwira Śliwińska, dr hab. inż. Iwona Jędrzejczyk, prof. PBŚ, dr hab. inż. Anna Figas, dr hab. inż. Dariusz Kulus prof. PBŚ, dr hab. inż. Justyna Lema-Rumińska, prof. PBŚ, dr Beata Szala.

Biological invasions – causes and consequences. Possibilities of specific and non-specific identification of microorganisms. Molecular diagnostics of plant pathogens. Molecular detection of air pollution by microorganisms in practice. Practical use of PCR techniques in plant protection. SMOs symbiotically modified organisms – pros and cons.

Genome sequencing - a breakthrough in genetics, agriculture and medicine. Seed refinement and quality testing. Methods of plant genome analysis. *Silphium perfoliatum* L. - a plant with potentially multidirectional use. Cryogenics in the protection of plant genetic resources. Plant production in the laboratory *of in vitro cultures.*

Production of secondary metabolites of plants in bioreactors. The importance of bacteria in the processes of biodegradation of agricultural waste and environmental protection. Bacterial biopreparations regulating the development, health and yielding of crops.

3. TEACHING METHODS

Multimedia lecture.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent enabling the revision of the existing paradigms in the field of agricultural biotechnology – including the global achievements, including theoretical foundations and general issues and selected specific issues related to this knowledge
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) main development trends in agricultural production biotechnology
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) scientific research methodology for agricultural production biotechnology
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to the results of biotechnological research
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) use knowledge in the field of agricultural biotechnology to creatively identify, formulate and innovatively solve complex problems and perform research tasks in the discipline of agriculture and horticulture
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critical evaluation of scientific achievements within the discipline of agriculture and horticulture

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a					x	
P8S_WG_b					x	
P8S_WG_c					x	
P8S_WK_c					x	
P8S_UW_a					x	
P8S_KK_a					x	

6. LITERATURE

Basic Literature

- Tokarska-Guzik B., Dojdak Z., Zając M., Zajęc A., Urbisz A., Danielewicz W., Hołdyński C. 2012. Rośliny obcego pochodzenia w Polsce ze szczególnym uwzględnieniem gatunków inwazyjnych. GDOŚ W-wa.
- Dyakov Yu.T., Dzhavakhiya V.G., Korpela T., 2007. Comprehensive and Molecular Phytopathology.
- Katoch R., 2011. Analytical Techniques in Biochemistry and Molecular Biology. Springer. ISBN 978-1-4419-9784-5
- Narayanasamy P., 2011. Microbial Plant Pathogens-Detection and Disease Diagnosis. Fungal Pathogens, Vol. 1. Springer. ISBN 978-90-481-9734-7
- Patejuk K., Baturo-Cieśniewska A., Pusz W., Kaczmarek-Pieńczewska A., 2022. Biscogniauxia charcoal canker—a new potential threat for mid-European forests as an effect of climate change. Forests 13, 89. https://doi.org/10.3390/f13010089

- Baturo-Cieśniewska A., Pusz W., Patejuk K., 2020. Problems, limitations, and challenges in species identification of Ascomycota members on the basis of ITS regions. Acta Mycologica 55 (1): Article 5512. https://doi.org/10.5586/am.5512
- Raja H.A., Miller A.N., Pearce C.J., Oberlies N.H., 2017. Fungal identification using molecular tools: a primer for the natural products research community. J. Nat. Prod. 80, 756–770. https://pubs.acs.org/doi/10.1021/acs.jnatprod.6b01085
- Narayanasamy P. 2011. Microbial plant pathogens-detection and disease diagnosis. Fungal Pathogens, Vol. 1. Springer. ISBN 978-90-481-9734-7
- Spadaro D., Agustí N., Ortega S.F., Ruiz M.A.H. 2020. Diagnostics and identification of diseases, insects and mites. Integrated pest and disease management in greenhouse crops 9: 231-258.
- Gundel P.E.; Pérez L.I.; Helander M.; Saikkonen K. 2013. Symbiotically modified organisms: Nontoxic fungal endophytes in grasses. Trends Plant Sci. 18: 420–427, doi:10.1016/j.tplants.2013.03.003.
- Dolezel J, Bartos J. 2005. Plant DNA flow cytometry and estimation of nuclear genome size. Ann Bot.;95(1):99-110. doi:10.1093/aob/mci005
- Muhammad Azhar Nadeem, Muhammad Amjad Nawaz, Muhammad Qasim Shahid, Yıldız Doğan, Gonul Comertpay, Mehtap Yıldız, Rüştü Hatipoğlu, Fiaz Ahmad, Ahmad Alsaleh, Nitin Labhane, Hakan Özkan, Gyuhwa Chung & Faheem Shehzad Baloch. 2018. DNA molecular markers in plant breeding: current status and recent advancements in genomic selection and genome editing, Biotechnology & Biotechnological Equipment, 32:2, 261-285
- Jedrzejczyk I., Rewers M. 2018. Genome size and ISSR markers for Mentha L. (Lamiaceae) genetic diversity assessment and species identification. Industrial Crops and Products 120: 171–179.
- Figas A. 2020. Wpływ nawadniania i fertygacji kroplowej siarczanem magnezu na wzrost, skład mineralny i parametry fizjologiczne rożnika przerośniętego Silphium perfoliatum L. na glebie bardzo lekkiej. Wydawnictwa Uczelniane UTP w Bydgoszczy.
- Roque-Borda C.A., Kulus D., Vacaro de Souza A., Kaviani B., Vicente E.F. 2021. Cryopreservation of agronomic plant germplasm using vitrification-based methods: An overview of selected case studies. International Journal of Molecular Sciences 22(11): 6157
- Kulus D., 2016. Application of cryogenic technologies and somatic embryogenesis in the storage and protection of valuable genetic resources of ornamental plants, [w:] Somatic Embryogenesis in Ornamentals and Its Applications, red. Mujib A., Springer India, New Delhi, pp. 1-25
- Reed B.M. 2008. (red.) Plant Cryopreservation: A Practical Guide. Springer-Verlag, New York,
- Lema-Rumińska J., Kulus D., Tymoszuk A., Varejao J. M.T.B., Bahcevandziev K., 2019. Profile of secondary metabolites and genetic stability analysis in new lines of *Echinacea purpurea* (L.) Moench micropropagated via somatic embryogenesis. Industrial Crops & Products 142: 111851.
- Nguyen T., Hosaka N.M., Kee Y.P., 2014 Optimization of ginseng cell culture in airlift bioreactors anddeveloping the large-scale production system. Industrial Crops and Products 60: 343–348.
- Błaszczyk, M. K. (2010). Mikroorganizmy w ochronie środowiska. Warszawa: Wyd. Nauk. PWN.
- Augustyniak A., Roszak M. 2017. Zastosowanie mikrobiologii w nowoczesnym rolnictwie. „Badania i Rozwój Młodych Naukowców w Polsce – Agronomia i ochrona roślin".
- Grzyb A., Waraczewska Z., Niewiadomska A., Wolna-Maruwka A. 2019. Czym są biopreparaty i jakie jest ich zastosowanie?. „Nauka – Przyroda – Technologie".
- Klimiuk E., Łebkowska M., 2003. Biotechnologia w ochronie środowiska Warszawa Wydawnictwo Naukowe PWN
- Kołwzan B. 2005. Bioremediacja gleb skażonych produktami naftowymi wraz z oceną ekotoksykologiczną. Oficyna Wyd. Politechniki Wrocławskiej, N.Wrocław.
- Kaszycki P., Petryszak P., Przepióra T., Supel P. 2013. Bioremediacja gleby zanieczyszczonej ksenobiotykami z wykorzystaniem autochtonicznych drobnoustrojów glebowych. 1. Podstawy procesu i badania modelowego. Czasopismo Naukowo-Kulturalne. Vol. 1(20).
- Janas R., 2009. Możliwości wykorzystania efektywnych mikroorganizmów w ekologicznych systemach produkcji roślin uprawnych. Problemy Inżynierii Rolniczej 3

Additional Literature

- Lemańczyk G., Łukanowski A., Baturo-Cieśniewska A. 2021. Poszukiwanie źródeł odporności owsa (*Avena sativa* L.) na nowy patogeniczny i mykotoksynotwórczy gatunek – *Fusarium langsethiae*. Biuletyn Instytutu Hodowli i Aklimatyzacji Roślin 295: 203–207.
- Pańka D., Jeske M., Łukanowski A., Prus P., Szwarc K., de Dieu Muhire J. 2021. Achieving the European Green "Deal" of Sustainable Grass Forage Production and Landscaping Using Fungal Endophytes. Agriculture 11, 390. https://doi.org/10.3390/agriculture11050390.
- Patterson J.D., Lafaillette F., Wöster S., Roulund N., Charrier S., Gilliland T.J. 2020. Impact of endophyte inoculation on the morphological identity of cultivars of *Lolium perenne* (L) and *Festuca arundinacea* (Schreb.). Sci. Rep. 10, 7729, doi:10.1038/s41598-020-64474-7.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.rio.IV
Item Name	**A block of subjects from the discipline of *agriculture and horticulture* to choose from:** **MODERN METHODS OF SOIL-PLANT RESEARCH**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Joanna Lemanowicz, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30**	prof. dr hab. M. Kobierski, prof. dr hab. B. Dębska, dr hab. inż. A. Siwik-Ziomek, prof. PBŚ, dr hab. inż. L. Gałęzewski, prof. PBŚ dr hab. inż. Roman Rolbiecki, prof. PBŚ, dr hab. inż. J. Bauza-Kaszewska, prof. PBŚ, dr hab. inż. A. Figas, prof. dr hab. inż. Anna Wenda Piesik, dr hab. inż. Grzegorz Lemańczyk, prof. PBŚ, prof. dr hab. D. Piesik, dr hab. inż. Dariusz Kulus, prof. PBŚ dr hab. inż. I. Jędrzejczyk, prof. PBŚ dr hab. inż. T. Knapowski, prof. PBŚ, dr hab. inż. E. Wszelaczyńska, prof. PBŚ, dr hab. inż. J. Poberężny, prof. PBŚ

1. Innovative use of aluminosilicate minerals.
2. Modern instrumental techniques used in the study of humic substances.
3. Extracting, cleaning enzymes and measuring their activity.
4. Methods of measuring soil moisture.
5. Modern research methods in the assessment of the needs and effects of plant irrigation and improvement of irrigation control.
6. Modern methods of treatment of organic waste and by-products used in agriculture.
7. The use of bioindicator plants to assess the state of the environment.
8. Analysis of crop growth using physiological indicators.
9. Studies on the soil-plant-pathogen tri-trophic system in terms of the severity of infectious diseases.
10. Methods of catching and breeding insects and the possibility of observing their behavior with the use of olfactometers.
11. Methods of protection and identification of plant genetic resources.
12. DNA barcoding in species identification.
13. The quality of technological indicators determining the use of grain and flour for food purposes.
14. The health-promoting value of vegetables resulting from storage technology.
15. The technological value of the potato depending on the innovative cultivation methods.

3. TEACHING METHODS

Lecture - 30 hours

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) to the extent that it is possible to revise the existing paradigms – the global achievement, including the theoretical foundations and methodology of scientific research with the use of advanced techniques and research tools in the discipline of *agriculture and horticulture*.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) the main development trends of research methods used in the discipline of *agriculture and horticulture*
P8S_WG_c	Context – conditions, effects c) aspects related to the methodology of scientific research for the discipline of agriculture and horticulture
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer and research results to economic entities operating in the agricultural field and commercialization of the results of scientific activity and know-how related to these results for the discipline *of agriculture and horticulture*
SKILLS: can	
P8S_UW_a	Leveraging knowledge – problems solved and tasks performed a)The use of knowledge, technology, research tools for creative solving of complex methodological problems typical of the discipline of *agriculture and horticulture*
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) critically analyse and evaluate the latest methods of scientific research, expert activity and other creative work and their contribution to the development of knowledge within the discipline *of agriculture and horticulture*

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a					x	
P8S_WG_b					x	
P8S_WG_c					x	
P8S_WK_c					x	
P8S_UW_a					x	

P8S_KK_a					x	

6. LITERATURE

Basic Literature

1) Nannipieri, P., Greco, S., Ceccanti, B. 2017. Ecological significance of the biological activity in soil. Soil biochemistry, 293-356.
2) Wojdyła T. 2006. Rośliny przemysłowe wykorzystywane w przemyśle spożywczym oraz metody analiz stosowanych w ich przetwórstwie. ATR, Bydgoszcz.
3) Adamicki F., Czerko Z. 2002. Przechowalnictwo warzyw i ziemniaka. PWRiL, Poznań.
4) Palich P. 2006. Podstawy technologii i przechowalnictwa żywności. AM, Gdynia.
5) Practical guidelines for the use of agricultural wastes, co-products and by-products. http://www.agrocycle.eu/
6) Kunal Ankola, LikhithGowda Mahadevegowda, Tomas Melichar, Manjunatha H. Boregowda, Chapter 18 - DNA barcoding: nucleotide signature for identification and authentication of livestock,
Editor(s): Sukanta Mondal, Ram Lakhan Singh, Advances in Animal Genomics, Academic Press, 2021, Pages 299-308, ISBN 9780128205952
7) Gałęzewski L., 2020. Wilgotność gleby - metodyczny aspekt badań rolniczych. Wydawnictwa uczelniane UTP w Bydgoszczy, 124 s.
8) Chojnacka A., 2015. Lotne Związki Organiczne (LZO): źródła emisji i metody ich usuwania. Wydawca: Poznań : Młodzi Naukowcy Jędrzej Nyćkowiak, 32-38
9) Wierzbicka, M. 2015. Ekotoksykologia rośliny, gleby, metale. Warszawa: Wydawnictwo Uniwersytetu Warszawskiego
10) Nowak L., Karczmarczyk S. (red.). Nawadnianie roślin. 2006. Monografia, PWRiL Poznań. 1-479.
11) Poorter H., VAN der Werf A. Is inherent variation in RGR determined by LAR at low irradiance and by NAR at high irradiance? A review of herbaceous species
12) Lema-Rumińska J., Miler N., Gęsiński K. 2018. Identification of new polish lines of Chenopodium quinoa (Willd.) by spectral analysis of pigments and a confirmation of genetic stability with SCoT and RAPD markers. Acta Scientiarum Polonorum Hortorum Cultus 17 (1): 75-86.
13) Singh D.P., Singh H.B., Prabha R. ed. 2017. Plant-Microbe interactions in agro-ecological perspectives. Volume 2: Microbial interactions and agro-ecological impacts. Springer Nature Singapore Pte Ltd
14) Mitek M., Leszczyński K. (red.) 2014. Wybrane zagadnienia z technologii żywności pochodzenia roślinnego. Wyd. SGGW Warszawa. ISBN: 9788375835762
15) Sarbak Z., 2009. Nieorganiczne materiały nanoporowate. Wydawnictwo Naukowe UAM
16) Metody badań substancji humusowych ekosystemów wodnych i lądowych (2004). Red. D. Gołębiowska, AR Szczecin

Additional Literature

1. Flaczyk, E., Korczak, J. 2004, Towaroznawstwo wybranych produktów spożywczych, AR Poznań.
2. Świderski F., Waszkiewicz-Robak B. 2010: Towaroznawstwo żywności przetworzonej z elementami technologii. SGGW, Warszawa

3. Zhang H, Li S, Zheng X, Zhang J, Bai N, Zhang H and Lv W (2021) Effects of Biogas Slurry Combined With Chemical Fertilizer on Soil Bacterial and Fungal Community Composition in a Paddy Field. Front. Microbiol. 12:655515. doi:10.3389/fmicb.2021.655515
4. Paul D. N. Hebert, T. Ryan Gregory, The Promise of DNA Barcoding for Taxonomy, Systematic Biology, Volume 54, Issue 5, October 2005, Pages 852–859
5. Robinson, D. A., C. S. Campbell, J. W. Hopmans, B. K. Hornbuckle, S. B. Jones, R. Knight, F. Ogden, J. Selker, and O. Wendroth (2008), Soil moisture measurements for ecological and hydrological watershed scale observatories: A review, Vadose Zone J., **7**, 358–389, doi:10.2136/vzj2007.0143
6. Piesik D., Bocianowski J., Sendel S., Krawczyk K., Kotwica K. 2020. Beetle orientation responses of Gastrophysa viridula and Gastrophysa polygoni (Coleoptera: Chrysomelidae) to a blend of synthetic volatile organic compounds. Environ. Entomol. 49(5): 1071–1076.
7. Traczewska, T.M. 2011. Biologiczne metody oceny skażenia środowiska. Oficyna Wydawnicza Politechniki Wrocławskiej
8. Kaniszewski S., 2005. Nawadnianie warzyw polowych. PlantPress Kraków. 3-85.
9. SHIPLEY B. 2002. Trade-offs between net assimilation rate and specific leaf area in determining relative growth rate: relationship with daily irradiance. Functional Ecology 2002 16, 682 – 689© 2002 British Ecological Society
10. Schulze E.D., Beck E., Buchmann N., Clemens S., Müller-Hohenstein K., Scherer-Lorenzen M. ed. 2019. Plant Ecology. Second Edition, Springer-Verlag GmbH Germany.
11. Schinner, F., Öhlinger, R., Kandeler, E., & Margesin, R. (Eds.). 2012. *Methods in soil biology*. Springer Science & Business Media.
12. Sadkiewicz J., Sadkiewicz J. 2009. Badania parametrów technologicznych ziarna, mąki i pieczywa. Wyd. Uczelniane UTP Bydgoszcz.Informacje o urządzeniach do badania zbóż, mąki i pieczywa, Zakład Badawczy Przemysłu Piekarskiego w Bydgoszczy, http://zbpp.com.pl/index_pl.php?cid=8
13. Biotechnologia – kwartalnik wydawany przez Komitet Biotechnologii PAN
14. Cademartiri L., Ozin G.A., 2012. Nanochemia. Podstawowe koncepcje. Wydawnictwo Naukowe PWN
15. Przewodnik metodyczny do badań materii organicznej gleb. (1999). Red. H. Dziadowiec i S.S. Gonet, Prace Komisji Naukowych PTG, 120, Bydgoszcz.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.zir.II
Item Name	**A block of subjects from the discipline of *animal science and fisheries* to choose from: ECOTECHNOLOGIES**
Course coordinator responsible for preparing the syllabus	dr inż. Radomir Graczyk

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30**	dr inż. Bogusław Chachaj, dr inż. Radomir Graczyk
The concept of sustainable development. Natural resource management. Environmental management in Poland. Enterprise Environmental Management. Eco-design. Energy policy, energy sources and production. Waste management. Ecotechnologies in rural areas (plant and animal production).		

3. TEACHING METHODS

Lectures – 15 hours
Lectures, multimedia presentations

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Understands the concept of sustainable development and the principles of rational use of natural resources. Knows the principles of environmental management at various levels. He knows the specifics of management in enterprises related to animal production and fishing.
P8S_WG_b	It understands what the energy policy implemented today is and understands the need for transformation in the future. He knows what responsible waste management in plant and animal production is all about.
P8S_WG_c	Context – conditions, effects c) knows the methodology of scientific research for a scientific discipline related to ecotechnology
P8S_WK_c	It shows understanding of the need to develop eco-technologies in rural areas. is aware of the importance of eco-technologies for the competitiveness of agri-food enterprises.

	c
SKILLS: can	
P8S_UW_a	He/she is able to propose schemes for correct environmental management, can indicate innovative methods of eco-design. It can propose rational solutions related to the management of natural resources. Knows how to propose innovative solutions in the field of environmental management.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	It is critical of all solutions with a view to sustainable development and care for the natural environment.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a				x		
P8S_WG_b				x		
P8S_WG_c				x		
P8S_WK_c				x		
P8S_UW_a				x		
P8S_KK_a				x		

6. LITERATURE

Basic Literature

1. Poskrobko B., Poskrobko T., 2012. Zarządzanie środowiskiem w Polsce, PWE, Warszawa.
2. Rosik-Dulewska C., 2021. Podstawy gospodarki odpadami. PWN, Warszawa.
3. Bogda A., Kabała C., Karczewska A., Szopka K., 2011. Zasoby naturalne i zrównoważony rozwój. Wydawnictwo Uniwersytetu Przyrodniczego we Wrocławiu. 460s.

Additional Literature

1. Stachura, M., Karwasz, A., 2007. Ekoprojektowanie w praktyce. Zeszyty Naukowe Politechniki Poznańskiej. Budowa Maszyn i Zarządzanie Produkcją, 5 , 51-61.
2. Łuczka W., 2021. Procesy rozwojowe rolnictwa ekologicznego i ich ekonomiczno-społeczne uwarunkowania. Scholar.
3. Szymańska J., 2012. Gospodarowanie zasobami ziemi w Polsce: aspekty teoretyczne i praktyczne. Monografie i Opracowania Uniwersytetu Ekonomicznego we Wrocławiu. 208, 308.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.zir.II
Item Name	**A block of subjects from the discipline of *animal science and fisheries* to choose from: BIOINFORMATICS**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Beata Sitkowska

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**30**	dr hab. inż., Beata Sitkowska
Use of bioinformatics resources, tools and software. Searching for information in biological databases. Biomedical literature. Familiarization with the resources of biological databases NCBI and Ensembl. Use of tools: Expression Atlas, BIOMART, GENEBUILD – REACTOME. Creation, analysis, search and matching of sequences of genetic material from plants and animals. Phylogenetic analyses of living organisms.		

3. TEACHING METHODS

Classes – 30 hours
Working on computers.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Understands the concept of biological and bioinformatics databases. Verifies the information needed for biotechnological analyses.
P8S_WG_b	Understands the main development trends and directions of changes in information placed in biological databases.
P8S_WG_c	He knows the methodology of scientific research based on the analysis of projects in the field of bioinformatics.
P8S_WK_c	He knows the possibilities of transferring bioinformatics knowledge to the economic sphere, mainly related to agriculture.
SKILLS: can	
P8S_UW_a	He uses modern research tools in the field of bioinformatics, has the ability to search, understand, analyze and creatively use the necessary information from various sources.
SOCIAL COMPETENCE: is ready to	

P8S_KK_a	He is critical of all solutions related to bioinformatics and its application in agriculture. Can analyze different approaches and choose the right ones.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			X			
P8S_WG_b			X			
P8S_WG_c			X			
P8S_WK_c			X			
P8S_UW_a			X			
P8S_KK_a			X			

6. LITERATURE

Basic Literature

1. Baxevanis A.D. (red.), Ouellette B.F.F. (red.), 2005. Bioinformatyka. Podręcznik do analizy genów i białek, PWN
2. Jin Xiong J., 2010. Podstawy bioinformatyki, WUW
3. Higgs P.W., Attwood T.K., 2008. Bioinformatyka i ewolucja molekularna, PWN

Additional Literature

1. Materiały edukacyjne na stronach internetowych: http://www.ncbi.nlm.nih.gov oraz http.ebi.ac.uk
2. Pevsner J. (red.), 2015. Bioinformatics and Functional Genomics. UK, Wiley-Blackwell.
3. Kolenda M., Sitkowska B. 2021. The polymorphism in various milk protein genes in Polish Holstein-Friesian dairy cattle. Animals 11(2), 389.
4. Sitkowska B., Kolenda M., 2020. Bioinformatyczne bazy danych w zrównoważonej intensyfikacji hodowli bydła mlecznego. Rozdział w: Zastosowanie współczesnych metod doskonalenia bydła i zarządzania stadem w kontekście ilości i jakości pozyskiwanych produktów, 2-32. Wydawnictwo UR w Krakowie, ISBN 978-83-66602-02-1

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.zir. III
Item Name	**A block of subjects from the discipline of *animal science and fisheries*to choose from:** **SCIENCE AND TECHNOLOGY IN SHAPING AGRICULTURAL FIELD**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Mariusz Bogucki, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. inż. Mariusz Bogucki, prof. PBŚ dr inż. Mirosław Banaszak

1. Agricultural market – importance in the global, European and national economy. Animal production market.
2-3. Technologies in the meat production process (pork, beef) and milk. Basics/new trends.
4-5. Scientific research in the field of improving the quality of animal products.
6-7. Innovative solutions in animal production creating a local/national agricultural market.
8-9. Determinants of research trends for the agricultural market.
10-11. Monitoring of the quality of the production environment as a tool to improve the competitiveness of the domestic agricultural market.
12-13. Dynamics of agricultural market development and sustainable development of the production process.
14-15. The role of research centers for the food chain.

3. TEACHING METHODS

Lecture – 15 hours
Auditorium lecture with elements of discussion with elements of project exercises

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) knows the existing, national and world scientific achievements, including basic theoretical and practical issues shaping agricultural markets in the field of animal production technology.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) knows and understands the main development trends of scientific disciplines, including the disciplines of animal husbandry and fisheries, which have a key impact on the technological development of animal agricultural production.

P8S_WG_c	Context – conditions, effects c) knows the methodology of scientific research for a scientific discipline related to animal agricultural production and the formation of the national agricultural market.
P8S_WK_c	Context – conditions, effects c) knows and understands the basic principles of the transfer of knowledge in the field of animal agricultural market to the economic and social sphere and commercialization of the results of scientific activity in this area.
SKILLS: can	
P8S_UW_a	Knowledge use – problems solved and tasks performed a) is able to use knowledge from various fields of science to identify, formulate and solve problems or perform research tasks in the field of improving the quality of products of animal origin, production efficiency and improving the competitiveness of the domestic agricultural market.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach a) is ready to evaluate scientific achievements within the discipline of animal husbandry and fisheries concerning the agricultural market – its importance, development, future.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation*	Discussion	Academic Essay
P8S_WG_a				x		
P8S_WG_b				x		
P8S_WG_c				x		
P8S_WK_c				x		
P8S_UW_a				x		
P8S_KK_a				x		

*** -** lectures 8-15 - students will perform an analytical study, a cross-sectional task - submitted in paper form.

6. LITERATURE

Basic Literature
1. Trzmielak D., Grzegorczyk M., Gregor B. 2018. Transfer wiedzy i technologii z organizacji naukowo-badawczych do przedsiębiorstw. Wydawnictwo Uniwersytetu Łódzkiego. 2. Warsewicz H., Krajewski K., Świątkowska M. 2013. Marketing żywności, Wolters . Kluwer Sp. z o.o. 3. Malchar-Michalska D. 2018. Pionowa koordynacja kontraktów w rolnictwie. Difin.
Additional Literature

1. Krzyżanowski J., 2015. Wspólna polityka rolna Unii Europejskiej w Polsce. Wydawnictwo CeDeWu.
2. Rynek rolny, Biuletyn miesięczny. IERiGŻ.
3. Selected scientific articles.
4. Selected legal provisions.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.zir.IV
Item Name	**A block of subjects from the discipline of *animal science and fisheries* to choose from:** **B+R PROJECT MANAGEMENT**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Aleksandra Dunisławska, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. inż. Aleksandra Dunisławska, prof. PBŚ dr hab. inż. Mirosław Banaszak, prof. PBŚ

1. Project and its features, R&D projects – definition and characteristics
2. Project management methodologies
3. Organization of communication in the project
4. Project risk management
5. Project quality management
6. Project communication
7. National and international programmes dedicated to young scientists
8. Group workshops – planning and managing your own research project

3. TEACHING METHODS

Seminar – 15 hours

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Understands the concept of project work. Verifies the information needed to manage the project.
P8S_WG_b	Understands the main development trends and directions of changes in research and development projects
P8S_WG_c	Knows the methodology of scientific research based on the analysis of research and development projects
P8S_WK_c	He knows the possibilities of transferring design knowledge to the economic sphere, mainly related to agriculture and animal husbandry.
SKILLS: can	
P8S_UW_a	It uses knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform tasks of a research nature in projects in disciplines of earth sciences.

SOCIAL COMPETENCE: is ready to	
P8S_KK_a	He is critical of all solutions related to project management. Can analyze different approaches and choose the right ones.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a				X		
P8S_WG_b				X		
P8S_WG_c				X		
P8S_WK_c				X		
P8S_UW_a				X		
P8S_KK_a				X		

6. LITERATURE

Basic Literature
1. Jerzy Kisielnicki, Zarządzanie projektami badawczo-rozwojowymi, Wydawnictwo Nieoczywiste, 2017 2. Robert K. Wysocki, Efektywne zarządzanie projektami, Wydawnictwo Onepress, 2018
Additional Literature
1. Ken Blanchard, Spencer Johnson, Jednominutowy Menadżer, Wydawnictwo MT Biznes, 2019 2. Ken Blanchard, Jednominutowy Menadżer buduje wydaje zespoły, Wydawnictwo MT Biznes, 2019 3. Mike Clayton, Zarządzanie czasem, Wydawnictwo samo sedno, 2011

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.zir. V
Item Name	**A block of subjects from the discipline of *animal science and fisheries* to choose from:** **ANIMAL RESEARCH MODELS**
Course coordinator responsible for preparing the syllabus	prof. dr hab. Maria Siwek-Gapińska

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	prof. dr hab. Maria Siwek-Gapińska dr inż. Elżbieta Pietrzak dr inż. Michalina Jawor dr inż. Magdalena Kolenda
Animal research models used in biology – species, characteristics, specific use in basic and applied research. Model animals. Animal cell lines. Transgenic animals. Animals knocked out. Organoids. Methods and ethics of conducting research on an animal model. Discussion on the further development of research on the animal model. Ethics of conducting research on an animal model.		

3. TEACHING METHODS

Lectures – 15 hours
Lectures, multimedia presentations

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Understands the concept of using animal models in both basic and applied research. Knows the principles of using cell lines as alternative models. Knows the specifics of conducting research on an animal model in accordance with the principles of ethics.
P8S_WG_b	Understands the use of animal models in basic and applied research. Knows what it means to use model animals responsibly in accordance with the principles of ethical research.
P8S_WK_c	Shows understanding of the necessity of applying the 3R principle (reduce, replace, reuse).
SKILLS: can	

P8S_UW_a	Can propose alternative research models based on tissue and cell cultures. It can propose rational solutions related to the use of model animals. He is able to propose innovative solutions based on the latest knowledge.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	He is critical of the use of model animals in basic and applied research.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a				x		
P8S_WG_b				x		
P8S_WG_c				x		
P8S_WK_c				x		
P8S_UW_a				x		
P8S_KK_a				x		

6. LITERATURE

Basic Literature

1. The current state of animals models in research: A review. Robinson N. et al., International Journal of Surgery, 2019, 72, 9 – 13
2. Thoughts on limitations of animal models, Hartung. Parkinsonisms & Related Disorders, 2008, 14.
3. Organoids by design. Takebe T. & Wells J. Science, 2019, 364, 956 – 959
4. Intestinal organoids in farm animals. Beaumont M., et al., Veterinary Research, 2021, 52, 33.

Additional Literature

Additional literature will be provided during classes based on the latest publications on the subject matter.

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	12.zir.VI
Item Name	**A block of subjects from the discipline of *animal science and fisheries* to choose from: NEXT-GENERATION FOOD**
Course coordinator responsible for preparing the syllabus	dr hab. inż. Aleksandra Dunisławska, prof. PBŚ

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VI	**15**	dr hab. inż. Aleksandra Dunisławska, prof. PBŚ dr inż. Elżbieta Pietrzak

1. Definitions, classification and legal conditions related to the classification of raw materials or food products referred to as "novel food".
2. Types of food of the new generation.
3. Attribution food
4. Probiotic foods
5. In vitro *food*
6. Types of novel foods: functional, convenience and transgenic foods.
7. GMOs in new generation food - definition, health safety.
8. Directions of research on genetically modified foods.
9. Technologies used in industrial food production.
10. Characteristics of selected plant raw materials approved for use as "novel food ingredients"

3. TEACHING METHODS

Lecture – 15 hours

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Understands the concept of next-generation food. Verifies information in the field of food production
P8S_WG_b	Understands the main development trends and directions of changes in the production of new generation food
P8S_WG_c	Knows the methodology of scientific research in the field of next-generation food production and food safety
P8S_WK_c	He knows the possibilities of transferring knowledge in the field of new generation food production to the economic sphere, mainly related to agriculture

SKILLS: can	
P8S_UW_a	It uses knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems.
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	He is critical of all solutions related to food production. Can analyze different approaches and choose the right ones.

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a			X			
P8S_WG_b			X			
P8S_WG_c			X			
P8S_WK_c			X			
P8S_UW_a			X			
P8S_KK_a			X			

6. LITERATURE

Basic Literature

1. Aleksandra Barody, Leszek Woźniak. Produkty nowej generacji, wydawnictwo Difin, 2019
2. Paweł Konrad Tuszyński, Probiotyki i prebiotyki – kompendium wiedzy dla farmaceutów i lekarzy, wydawnictwo farmaceutyczne, 2021
3. Elżbieta Goryńska-Goldmann, Weronika Mytko, Zrównoważona konsumpcja żywności. Wybrane działania wspierające jej rozwój, wydawnictwo Difin, 2021
4. Alan McHughen, Żywność modyfikowana genetycznie, WNT Wydawnictwa Naukowo-Techniczne, 2004

Additional Literature

1. Articles from current literature on the subject of the subject.
2. Applicable legal acts

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	13
Item Name	**ACADEMIC ENTREPRENEURSHIP**
Course coordinator responsible for preparing the syllabus	dr inż. Mateusz Wirwicki

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VII	**15**	dr inż. Mateusz Wirwicki mgr Piotr Jankowski

Semester VII
dr inż. Mateusz Wirwicki - 10 hours
mgr Piotr Jankowski - 5 hours

1. Academic entrepreneurship – how much learning in business? - 1.5 hours
2. Commercialization – types and forms of learning transfer to business – 1.5 hours
3. Financing of academic enterprises - 1.5 hours
4. Business Model Canvas – 3 hours
5. Conditions for the establishment and functioning of academic enterprises. Planning and building a spin off/ spin out venture - 3 hours
6. Conditions and forms of knowledge transfer. Relations between the sphere of science and business. Concepts and principles in the field of industrial property protection and copyright related to the creation of new ventures - 3 hours
7. Business model presentation – 1.5 hours

3. TEACHING METHODS

Lecture – 15 hours
multimedia presentation, demonstration, discussion, lecture, case method, informative lecture, conversational lecture, problem-based lecture

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_d	Scope and depth – completeness of cognitive perspective and dependencies d) principles of dissemination of the results of scientific activity for the sphere of business
P8S_WK_c	Context – conditions, effects c) basic principles of knowledge transfer to the economic and social sphere and commercialization of the results of scientific activity and know-how related to these results

SKILLS: can	
P8S_UW_c	Knowledge use – problems solved and tasks performed c) transfer the results of scientific activity to the economic and social sphere in the form of academic entrepreneurship
P8S_UK_b	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language b) disseminate the results of scientific activity, also in forms popular within the framework of academic entrepreneurship
P8S_UO_a	Work organization – planning and teamwork a) plan and implement individual and team research or creative projects in the academic environment
P8S_UU_a	Learning – planning your own development and the development of others a) independently plan and act for their own development and inspire and organize the development of others in the field of academic entrepreneurship organization
SOCIAL COMPETENCE: is ready to	
P8S_KO_c	Responsibility – fulfilling social obligations and acting for the public interest c) think and act in an entrepreneurial way in business

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Egzamin ustny	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_d				X		
P8S_WK_c				X		
P8S_UW_c				X		
P8S_UK_b				X		
P8S_UO_a				X		
P8S_UU_a				X		
P8S_KO_c				X		

6. LITERATURE

Basic Literature

1. Mariusz-Jan Radło, Michał Baranowski, Tomasz Napiórkowski, Jarosław Chojecki, Komercjalizacja, wdrożenia i transfer technologii definicje i pomiar dobre praktyki wybranych krajów, Oficyna Wydawnicza SGH, Warszawa 2020;
2. Urząd Marszałkowski Województwa Mazowieckiego w Warszawie, Komercjalizacja Wyników Badań naukowych Praktyczny poradnik dla naukowców, Warszawa 2013
3. Korytkowski P., Kulczycki E., Opis wpływu działalności naukowej na funkcjonowanie społeczeństwa i gospodarki. Podręcznik dla ewaluowanych podmiotów, 2019
4. Jan Bagiński, Aleksander Buczacki, Krzysztof Santarek, Anna Szerenos, Dariusz Sobczak, Transfer technologii z uczelni do biznesu, tworzenie mechanizmów transferu technologii, Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2008
5. Banerski G, Gryzik A., Matusiak K. B., Mażewska M., Stawasz E., „Przedsiębiorczość akademicka (rozwój firm spin-off, spin-out) – zapotrzebowanie na szkolenia służące jej rozwojowi" Raport z badania, Wyd. Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2009r. - https://www.efs.2007-

2013.gov.pl/AnalizyRaportyPodsumowania/baza_projektow_badawczych_efs/Documents/przedsiebiorczosc_akademicka_raport30032011.pdf
6. Barski R., Cook T. „Metodyka identyfikacji projektów do komercjalizacji na wyższych uczelniach", PARP, Warszawa, 2011 - https://www.pi.gov.pl/PARPFiles/file/metodyka_identyfikacji.pdf
7. Santarek K. (red.) „Transfer technologii z uczelni do biznesu", Wyd. Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2008 r. - https://www.parp.gov.pl/files/74/81/194/4372.pdf
8. Tamowicz P., Przedsiębiorczość akademicka. Spółki spin-off w Polsce. PARP Warszawa 2006r. - https://www.parp.gov.pl/storage/publications/pdf/1111.pdf

Additional Literature

1. Wissema J. G., „Technostarterzy - Dlaczego i jak?" Wyd. Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2005.
2. Charnas T. (red.) „Z innowacją w biznes" INFOR Training, Kraków 2010.
3. Trzmielak D., Zehner W., „Metodyka i organizacja doradztwa w zakresie transferu technologii i komercjalizacji wiedzy", PARP, Warszawa, 2011.
4. Kowalczyk I., Pawłowska J., Sarti F., Zago Biasetti I., „Metody inkubacji projektów biznesowych", PARP, Warszawa, 2011.
5. Your Guide to IP Commercialisation - The European IP Helpdesk - https://www.iprhelpdesk.eu/sites/default/files/2018-12/european-ipr-helpdesk-your-guide-to-ip-commercialisation.pdf
6. The role of public support in the commercialisation of innovations – Report - http://ec.europa.eu/commfrontoffice/publicopinion/flash/fl_394_en.pdf
7. Gródek-Szostak Z., "Transfer of technology in practice" - http://www.imim.pl/PHD/www.imim-phd.edu.pl/contents/Lectures/GRODEK%20SZOSTAK%20Commercialization%20of%20scientific%20research.pdf

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	14
Item Name	**INTERNSHIP**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Dariusz Skibicki

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
VII	**30**	prof. dr hab. inż. Dariusz Skibicki
Participation or independent teaching with students at the Bydgoszcz University of Technology. Classes are organized and supervised by the doctoral student's supervisor.		
VIII	**30**	prof. dr hab. inż. Dariusz Skibicki
Participation or independent teaching with students of Bydgoszcz University of Technology. Classes are organized and supervised by the doctoral student's supervisor.		

3. TEACHING METHODS

Participation in classes or conducting classes on their own.

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
SKILLS: can	
P8S_UK_c	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language c) initiate a debate with students
P8S_UO_a	Work organization – planning and teamwork a) Can plan and implement individual and team research or creative projects with domestic or foreign students
P8S_UU_a	Learning – planning your own development and the development of others a) Is able to independently plan and act for his/her own development and inspire and organize the development of other people, including Polish and foreign students
P8S_UU_b	Learning – planning your own development and the development of others b) Can plan classes or groups of classes with students and implement them using modern methods and tools

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	~~Discussion~~ Visit	Academic Essay
P8S_UK_c					X	
P8S_UO_a					X	
P8S_UU_a					X	
P8S_UU_b					X	

6. LITERATURE

Basic Literature
Not applicable
Additional Literature
Not applicable

POLITECHNIKA BYDGOSKA
Szkoła Doktorska

HR EXCELLENCE IN RESEARCH

SYLLABUS

1. ITEM INFORMATION

Plan Item	15
Item Name	**DISSERTATION WORKSHOP**
Course coordinator responsible for preparing the syllabus	prof. dr hab. inż. Dariusz Skibicki

2. DIVISION INTO SEMESTERS, HOURS AND CURRICULUM CONTENT

semester	hours	Host
And	**15**	Disciplines of engineering and technical sciences prof. dr hab. inż. Janusz Sempruch prof. dr hab. inż. Dariusz Skibicki prof. dr hab. inż. Dariusz Boroński Disciplines of natural sciences prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Roman Rolbiecki

Doctoral school and doctoral dissertation

The lecture discusses: the regulations of the doctoral school, the education plan at the doctoral school, the division into fields and disciplines of science in Poland and in the world, the system of academic degrees and titles in Poland and in the world, the problem of what science is, what is a doctoral dissertation, what are the statutory requirements for it, what is the structure of the dissertation, what does the review of a doctoral dissertation look like, what is the course of the doctoral dissertation defense.

As part of the seminar part, an analysis of examples of doctoral dissertations is conducted. Presentations of selected doctoral dissertations are prepared by doctoral students.

II	**15***	Disciplines of engineering and technical sciences prof. dr hab. inż. Janusz Sempruch prof. dr hab. inż. Dariusz Skibicki prof. dr hab. inż. Dariusz Boroński Disciplines of natural sciences prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Roman Rolbiecki

*subject taught separately in a discipline or group of disciplines

Preparation of an individual research plan

PhD students present their proposals for individual research plans. Initially, doctoral students present the genesis of their research problem. Then they formulate the individual elements of the Individual Research Plan: the title of the dissertation, the research objective or hypothesis; expected results, contribution to the development of the discipline, research tasks, publication of a scientific article, scientific internship,

dissertation preparation plan. Presentation of complete IRPs by individual PhD students combined with discussion, submission of comments and suggestions. In addition, as part of the course, doctoral students will learn about the Regulations of the procedure for awarding or refusing to award a doctoral degree at PBS; with the Code of the National Science Centre on the integrity of scientific research and applying for research funding.

III	**15***	Disciplines of engineering and technical sciences prof. dr hab. inż. Janusz Sempruch prof. dr hab. inż. Dariusz Skibicki prof. dr hab. inż. Dariusz Boroński Disciplines of natural sciences prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Roman Rolbiecki

*- subject taught separately in a group of disciplines

Literature Studies

On the basis of the "aims and scope" of the journal and the list of journals of the ministry, the doctoral student is able to identify journals in his discipline. On the basis of the Impact Factor and the scoring of the list of journals of the Ministry, it is able to determine the rank of a journal.
The PhD student gets acquainted with the managers of scientific publications such as EndNote, Publons, Mendeley.
The doctoral student presents the results of literature studies related to the subject of his doctoral dissertation. On this basis, the student is able to identify the most important research trends in his scientific discipline and indicate the place of his research topic against this background. Can justify the purpose and scope of his dissertation.

IV	**15***	Disciplines of engineering and technical sciences prof. dr hab. inż. Janusz Sempruch prof. dr hab. inż. Dariusz Skibicki prof. dr hab. inż. Dariusz Boroński Disciplines of natural sciences prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Roman Rolbiecki

*- subject taught separately in a group of disciplines

Preparing for the mid-term evaluation

The doctoral student prepares and consults a report and presentation for mid-term evaluation. In addition, the PhD student becomes familiar with the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers (HR Excellence in Research logo). The doctoral student learns about the elements of ethics and responsibility applied in scientific research, taking into account, m.in, ethical planning, implementation and publication of research results. A PhD student resolves issues related to copyright, conflicts of interest and liability in the implementation of multi-author research.

V	**15***	Disciplines of engineering and technical sciences prof. dr hab. inż. Janusz Sempruch prof. dr hab. inż. Dariusz Skibicki

		prof. dr hab. inż. Dariusz Boroński Disciplines of natural sciences prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Roman Rolbiecki

*- subject taught separately in a group of disciplines

Description of the research workshop

The PhD student presents his or her research workshop: the test bench, measuring instruments, the software used, the research methods used, data analysis, etc. He pays particular attention to the elements of the workshop designed and made by himself.

VI	**15***	Disciplines of engineering and technical sciences prof. dr hab. inż. Janusz Sempruch prof. dr hab. inż. Dariusz Skibicki prof. dr hab. inż. Dariusz Boroński Disciplines of natural sciences prof. dr hab. inż. Maria Siwek-Gapińska dr hab. inż. Roman Rolbiecki

*- subject taught separately in a group of disciplines

Characteristics of scientific supervisors and research units

The doctoral student prepares a description of the scientific profile of the supervisor, including the scope of his scientific interests, scientific achievements, bibliometric indicators. Examples of career paths of the world's best scientists; scientometric tools; developing a scientist's profile in dedicated social media (e.g. EURAXESS); development of a scientific curriculum vitae; harmonious and conscious management of a scientific career.

The doctoral student prepares the characteristics of the scientific unit in which the supervisor is employed, m.in. the scientific profile of the unit, its research facilities: machines, devices, software and the scope of cooperation with the economic environment.

VII	**15**	prof. dr hab. inż. Janusz Sempruch

Presentation of the results of own research

The PhD student presents the results of his own research. It discusses methods of analyzing results. The results are discussed and conclusions are formulated.

VIII	**15**	prof. dr hab. inż. Dariusz Skibicki

Presentation of the self-report

1. Explanation of the procedure for submitting a doctoral dissertation at the Doctoral School (APD and JSA).
2. Summary of education – doctoral students evaluate education and propose changes to the education process.

3. What is science? – discussion on the scientific procedure, what strictly research elements I performed, discussion of cognitive biases, explanation of the limitations of science.
4. A PhD student learns to evaluate and analyse scientific fields using tools such as SCImago Journal & Country Rank and Claritive Essential Science Indicators. It analyzes the research results of leading institutions, countries, journals, authors and articles. The PhD student identifies research trends in technical and natural sciences.
5. The doctoral student presents a self-report prepared for the defense of his doctoral dissertation.

3. TEACHING METHODS

Lecture – 8 hours
Seminar – 7 hours
Classes are held in the form of a lecture and a seminar

4. LEARNING OUTCOMES FOR THE COURSE

Reference to learning outcomes	Description of the learning outcomes for the course
KNOWLEDGE: knows and understands	
P8S_WG_a	Scope and depth – completeness of cognitive perspective and dependencies a) A PhD student understands the paradigm of modern science. He understands what science is. He is familiar with the specifics of the disciplines represented in the doctoral school.
P8S_WG_b	Scope and depth – completeness of cognitive perspective and dependencies b) by actively and passively participating in interdisciplinary seminars, learns about the main development tendencies of groups of natural and engineering and technical disciplines,
P8S_WG_c	Scope and depth – completeness of cognitive perspective and dependencies c) when developing an individual research plan, familiarises themselves with the methodology of scientific research specific to their scientific discipline
SKILLS: can	
P8S_UK_a	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language a) when presenting his/her scientific achievements, he/she is able to communicate on specialist topics to the extent that allows active participation in the international scientific community
P8S_UK_c	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language c) when presenting his/her scientific achievements, he/she is able to initiate a debate on them
P8S_UK_d	Communication – receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language d) participate in an interdisciplinary scientific discourse on the achievements of themselves and other doctoral students
P8S_UU_a	Learning – planning your own development and the development of others a) when preparing an individual research plan, is able to independently plan his/her scientific development and act for his/her own development
P8S_UU_b	Learning – planning your own development and the development of others b) when presenting his/her scientific achievements, he/she is able to plan classes and implement them with the use of modern methods and tools
SOCIAL COMPETENCE: is ready to	
P8S_KK_a	Evaluations – a critical approach

	a) when characterizing supervisors and the research unit, is ready to critically evaluate the achievements within a given scientific discipline
P8S_KK_b	Evaluations – a critical approach b) when presenting a self-report, is ready to critically evaluate his/her own contribution to the development of a given scientific or artistic discipline
P8S_KK_c	Evaluations – a critical approach c) by describing his/her research workshop, he/she learns to recognize the importance of knowledge in solving cognitive and practical problems
P8S_KR_a	Professional role – independence and ethos development Understands the professional role of a scientist in contemporary society

5. METHODS OF VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY A DOCTORAL STUDENT

Learning Outcome	Form of assessment					
	Oral exam	Written exam	Colloquium	Presentation	Discussion	Academic Essay
P8S_WG_a				X		
P8S_WG_b				X		
P8S_WG_d				X		
P8S_UK_a				X		
P8S_UK_c				X		
P8S_UK_d				X		
P8S_UU_a				X		
P8S_UU_b				X		
P8S_KK_a				X		
P8S_KK_b				X		
P8S_KK_c				X		
P8S_KR_a				X		

6. LITERATURE

Basic Literature

1. The National Science Centre's Code on the integrity of scientific research and applying for research funding. National Science Centre, 2016.
2. European Charter for Researchers. Code of Conduct for the Recruitment of Researchers. European Commission, 2006
3. Steneck, Nicholas H. ORI introduction to the responsible conduct of research. Government Printing Office, 2007.
4. Regulations of the Doctoral School
5. Act of 20 July 2018. Law on Higher Education and Science

Additional Literature

1. Patience, Gregory S., et al. "Intellectual contributions meriting authorship: Survey results from the top cited authors across all science categories." PLoS One 14.1 (2019): e0198117.
2. Van Noorden, Richard. "Online collaboration: Scientists and the social network." Nature news 512.7513 (2014): 126.