



Subject card

Subject name and code	Modeling and prediction methods in biomedical processes, PG_00053372						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2023/2024		
Education level	second-cycle studies	Subject group			Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Artur Poliński					
	Teachers	dr inż. Artur Poliński dr Tomasz Neumann					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours		Self-study	SUM	
	Number of study hours	30	5.0		40.0	75	
Subject objectives	The aim of the course is present the methods of modeling and prediction in biomedical applications						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W01] Knows and understands, to an increased extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study.	The student has knowledge of modeling and prediction in biomedical applications			[SW1] Assessment of factual knowledge		
	[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by:n-appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n-application of appropriate methods and toolsn	The student has knowledge of numerical modeling of processes and signal prediction in biomedical applications			[SU1] Assessment of task fulfilment		
	[K7_W02] Knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study	The student has knowledge of modeling and prediction in biomedical applications			[SW1] Assessment of factual knowledge		
	[K7_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions	Numerical simulations related to modeling and prediction in biomedical applications			[SU1] Assessment of task fulfilment		

Subject contents	<p>The least squares method (LS). Examples of using the LS in modeling.          Examples of phenomena modeled by ordinary differential equations. Numerical solution of ordinary differential equations (Euler and Rungge-Kutta methods)          Examples of problems modeled by partial differential equations. Numerical solving of partial differential equations by the finite difference method          Numerical solving of partial differential equations using the finite element method          Numerical solution of partial differential equations by the boundary element method          Monte Carlo method and its application in simulation          Examples of signal prediction methods          Autoregressive models in prediction          The use of the finite element method and the boundary element method in modeling.          Modeling of the electromagnetic field.          Heat transfer modeling.          Modeling of acoustic phenomena.</p>		
Prerequisites and co-requisites	Advanced mathematics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	laboratory	51.0%	60.0%
	lecture	51.0%	40.0%
Recommended reading	Basic literature	<p>Analiza danych, Metody statystyczne i obliczeniowe, 1998, Siegmund Brandt, PWN</p> <p>Monte Carlo Methods for Radiation Transport, 2017, Oleg N.Vassiliev, Springer</p> <p>Fortuna Z., Macukow B., Wąsowski J., Metody numeryczne, WNT 2006          Stoer J., Bulirsch R., Wstęp do analizy numerycznej, PWN 1987          Ralston A., Wstęp do analizy numerycznej, PWN 1983          Björck A., Dahlquist G., Metody numeryczne, PWN 1983</p> <p>Zienkiewicz O. C., Metoda elementów skończonych, Arkady 1972</p> <p>Beer G., Watson J. O., Introduction to finite and boundary element methods for engineers, John Wiley 1994</p> <p>Ciarlet P. G, Lions J. L. red. Finite difference methods (Part 1) ; Solution of equations in R (Part 1), Amsterdam : North-Holland, 1990.          Allen M. B. III, Isaacson E. L., Numerical analysis for applied science, John Wiley, 1997          Metoda elementów skończonych w dynamice konstrukcji, praca zbiorowa, Warszawa Arkady 1984          Grandin H. T., Fundamentals of the finite element method, New York : Macmillan ; London : Collier Macmillan, 1986.          Björck A., Numerical methods for least squares problems, SIAM, Philadelphia, 1996          Bettles P., Infinite Elements, Penschaw Press, Sunderland, UK, 1992</p>	
	Supplementary literature	<p>Jankowscy J. i M., Przegląd metod i algorytmów numerycznych. Cz. 1, WNT 1988          Dryja M., Jankowska J., Jankowski M., Przegląd metod i algorytmów numerycznych. Cz. 2, WNT 1988          Golub G., Van Loan C., Matrix Computations. Johns Hopkins University Press, 1996          Biran A., Breiner M., MATLAB 5 for engineers, Harlow, England : Addison-Wesley, 1999          Kruszewski J. red., Metoda sztywnych elementów skończonych, Warszawa : Arkady, 1975.</p>	
	eResources addresses	<p>Adresy na platformie eNauzanie:          Modelowanie i metody predykcji w procesach biomedycznych zima 2023 - Moodle ID: 29413  <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=29413">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=29413</a></p>	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		