



Subject card

Subject name and code	Modeling and prediction methods in biomedical processes, PG_00068266						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	February 2027	Academic year of realisation of subject			2027/2028		
Education level	second-cycle studies	Subject group			Optional subject group Specialty 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			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Artur Poliński					
	Teachers	dr inż. Artur Poliński dr Tomasz Neumann					
Lesson types	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		3.0		17.0	50
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: - appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation, - application of appropriate methods and tools	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_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions	The student has knowledge of modeling and prediction in biomedical applications	[SU1] Assessment of task fulfilment	
Subject contents	<p>Course content – lecture</p> <p>The least squares method (LS). Examples of using the LS in modeling.</p> <p>Examples of phenomena modeled by ordinary differential equations. Numerical solution of ordinary differential equations (Euler and Runge-Kutta methods)</p> <p>Examples of problems modeled by partial differential equations. Numerical solving of partial differential equations by the finite difference method</p> <p>Numerical solving of partial differential equations using the finite element method</p> <p>Numerical solution of partial differential equations by the boundary element method</p> <p>Monte Carlo method and its application in simulation</p> <p>Examples of signal prediction methods</p> <p>Autoregressive models in prediction</p> <p>The use of the finite element method and the boundary element method in modeling.</p> <p>Modeling of the electromagnetic field.</p> <p>Heat transfer modeling.</p> <p>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 Bettes P., Infinite Elements, Penshaw 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	
Example issues/ example questions/ tasks being completed		
Practical activities within the subject	Not applicable	

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