GDAŃSK UNIVERSITY OF TECHNOLOGY

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 2024	Academic year of realisation of subject	2024/2025
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	

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 apllications

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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 apllications	[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_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_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

Subject contents	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.
Prerequisites and co-requisites	Advanced mathematics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
lecture	51.0%	40.0%
laboratory	51.0%	60.0%

Recommended reading

Basic literature	Analiza danych, Metody statystyczne i obliczeniowe, 1998, Siegmund Brandt, PWN Monte Carlo Methods for Radiation Transport, 2017, Oleg N.Vassiliev, Springer 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 Å., Dahlquist G., Metody numeryczne, PWN 1983 Zienkiewicz O. C., Metoda elementów skończonych, Arkady 1972 Beer G., Watson J. O., Introduction to finite and boundary element methods for engineers, John Wiley 1994 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 Å., Numerical methods for least squares problems, SIAM, Philadeplhia, 1996 Bettes P., Infinite Elements, Penshaw Press, Sunderland, UK, 1992
Supplementary literature	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.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable