

Course title: Specialised lecture

ECTS credit allocation (and other scores): 3

Semester: autumn

Level of study: ISCED-6 - first-cycle programmes (EQF-6)

Branch of science: Natural sciences

Language: English /Polish

Number of hours per semester: 45 lectures

Course coordinator/ Department and e-mail: Mariusz Bodzioch / WMil, mariusz.bodzioch@matman.uwm.edu.pl

Type of classes: lectures

Substantive content

LECTURES: Ordinary differential equations. Evolutionary processes. Geometric and physical interpretation. Existence and ambiguity of solutions. Numerical determination of solutions. Stability of equilibrium points. Lyapunov function. Phase space analysis. Linear and non-linear functions. Bifurcations. Deterministic chaos. Discrete models. Single population models: the Malthus model and the Verhulst model. Models of interactions between two populations: Lotka-Volterra model, a system of competing species, symbiosis. Epidemiological models.

Learning purpose: To learn the qualitative ordinary differential equation theory and its applications in mathematical modelling of physical, biological and population processes.

On completion of the study programme the graduate will gain:

Knowledge: The student knows the fundamentals of algebra, analysis and other branches of mathematics necessary for application in other branches of mathematics; the importance of applications of mathematics in other sciences.

Skills: The student can apply mathematical models in broadly understood applications of mathematics; apply methods of qualitative differential equation theory to investigate deterministic discrete and continuous models; formulate and interpret simple population models.

Social Competencies: The student is prepared to collaborate in a group, and continuously broaden his/her knowledge.

Basic literature: 1) U. Foryś, Modelowanie matematyczne w biologii i medycynie, Uniwersytet Warszawski, 2011; 2) J.D. Murray, Mathematical Biology I. An Introduction, Springer, 2002; 3) A. Palczewski, Równania różniczkowe zwyczajne, WNT, 2004.

Supplementary literature: V.I Arnold, Ordinary Differential Equations, Springer, 1992; 2) I. Białynicki-Birula, I. Białynicka-Birula, Modelowanie rzeczywistości. Jak w komputerze przegląda się świat, WNT, 2007; 3) A. Ralston, Wstęp do analizy numerycznej, PWN, 1971; 4) R. Rudnicki, Modele i metody biologii matematycznej. Część I: Modele deterministyczne, IMPAN, 2014.

The allocated number of ECTS points consists of:

Contact hours with an academic teacher: 1.88 ECTS points.

Student's independent work: 1.12 ECTS points.