Mathematical Institute
Polish Academy of Sciences

COURSE DESCRIPTION

Course name	Population dynamics
Course type	reading course (wrd)
Supervisor	Prof. dr hab. Ryszard Rudnicki
ECTS credit allocation	4 – IM PAN Ph. D. program; 6 - recommended for MA programs
Duration	One semester
Number of hours	30
Language	English or Polish, if every participant speaks Polish
Prerequisites	Theory of differential equation on the graduated level. Proposition is addressed to PhD students specializing in applications of mathematics in biology.
Course content	1. Principles of mathematical modeling. The origin of population dynamics: Fibonacci's, Malthus', and Verhulst's models. Seasonality in population dynamics. 2. Basic Volterra-Lotka pray-predator model and its ecological implications. Kolmogorov model: long time behaviour of solutions, the existence of the limit cycle. 3. Kermack-McKendrick epidemic model. 4. Discrete structured models. Perron theorem and its applications. Birth-death processes and models from genetics with infinite number of populations. 5. Continuous structured models. Age-structured demographic model and asynchronous exponential growth of the population. Size and phenotype structure models.
Recommended reading	1. R. Rudnicki, Models and methods of mathematical biology (in Polish), preprint. 2. H.R. Thieme, Mathematics in Population Biology, Princeton University Press, Princeton, 2003. 3. J. D. Murray, Mathematical Biology. I. An Introduction, Interdisciplinary Applied Mathematics, 17. Springer-Verlag, New York, 2002.
Learning outcomes	To familiarize students with principles of modeling; presentation of basic models of population dynamics with active participation of students in their creation and analysis; introduction of mathematical methods essential to study models. Students also learn qualitative methods of the theory of differential equations and semigroups of operators useful in other theoretical and practical problems.
Assessment methods and criteria	Lists of exercises and exam
Remarks	