Course title:	Modeling of mass and energy flow in terrestrial ecosystems
Course title in Polish:	Modelowanie przepływu masy i energii w ekosystemach lądowych
Course for discipline:	environmental engineering, mining and energy, agriculture and horticulture, forestry

Semester:	3	**Status of course:**	faculty	**Language:**	english
Academic year:		**Catalog number:**			

Coordinator of course:	Assistant professor Tomasz Gnatowski
Lecturer od course:	Assistant professor Tomasz Gnatowski, Assistant professor Jan Szatyłowicz
Executing unit:	Institute of Environmental Engineering, Department of Environmental Management
Ordering unit:	Doctoral School SGGW
Assumptions, goals and description of the course:	Introduction to basic issues in the field of mass and energy flow in the soil-plant-atmosphere system. Mathematical description of water flow and soil heat. Analytical and numerical solutions of contaminant migration in soil. Characteristics of existing simulation models of water flow in the soil-plant-atmosphere system. Parameterization and schematization of soil media for the purposes of modeling transport processes in soil. Water uptake by plant roots. Initial and boundary conditions in numerical equations. Examples of applications of numerical solutions of water and thermal conductivity equations and hydrodynamic dispersion in environmental engineering issues. The implementation of learning outcomes involves preparing the doctoral student to use professional literature and apply knowledge in the field of mathematical modeling of mass and energy flow in terrestrial ecosystems.
Didactic form, number of hours:	computer exercises, 10h
Teaching methods:	Introduction to exercises, performing numerical simulation, analysis and interpretation of the obtained calculation results, discussion
Limit of people in the group:	

Learning outcomes

KNOWLEDGE - the graduate knows and understands:	**SKILLS - the graduate is able to:**	**COMPETENCES - the graduate is ready to:**
To the extent enabling to revise the existing pradigms in the field/discipline - the world achievments, gathering theoretical background as well as general and selected detailed issues	Carry out critical assessment of the scientific research findings and expert activities and their contribution to the knowledge development in the field/discipline	Critically evaluate the achievments in the field/discipline represented
Major general development trends in the field/discipline		Recognise knowledge in solving cognitive and practical problems characteristic for the area of research (field/discipline) and in an interdisciplinary aspect
		Support the ethos of scientific circles and conduct independent research

The method of verification of learning outcomes:	Assessment of exercise reports, team discussion
Form of documentation of achieved learning outcomes:	Report on completed exercises, files with simulation results
Elements and weights of the final grade:	Final score: assessment of the correctness of the report (50%) and the substantive level of the discussion (50%)
Place of the course:	computer room

Basic and supplementary literature

Hanks R. J., 1992: Applied soil physics. Springer-Verlag, (2nd ed.); pp. 176
Hillel, D. 1998: Environmental soil physics: Fundamentals, applications, and environmental considerations. Elsevier; pp. 771.
Jury W.A., W.R. Gardner, W.H. Gardner, 1991: Soil Physics (fifth ed.), John Wiley & Sons; pp. 328
Kutilek M., D.R. Nielsen, 1994: Soil hydrology. Catena-Verlag; pp. 370
Radcliffe, D. E., Simunek, J. 2010: Soil physics with HYDRUS: Modeling and applications. CRC press; pp. 388
Warrick A. W. (ed.), 2002: Soil physics companion. CRC Press; pp 389

Comments:	-

Estimated number of hours of work of the doctoral student necessary to achieve the assumed learning outcomes:	30 h

Leraning outcomes reference to the second degree characteristics of the National Qualification Framework (level 8) covering doctoral competences:

Symbol:	**Learning outcomes:**	**8 level NQF**
SD1_KW01	To the extent enabling to revise the existing pradigms in the field/discipline - the world achievments, gathering theoretical background as well as general and selected detailed issues	P8S_WG
SD1_KW02	Major general development trends in the field/discipline	P8S_WG
SD1_KU05	Carry out critical assessment of the scientific research findings and expert activities and their contribution to the knowledge development in the field/discipline	P8S_UW
SD1_KK01	Critically evaluate the achievments in the field/discipline represented	P8S_KK
SD1_KK03	Recognise knowledge in solving cognitive and practical problems characteristic for the area of research (field/discipline) and in an interdisciplinary aspect	P8S_KK
SD1_KK08	Support the ethos of scientific circles and conduct independent research	P8S_KR