PhD Course:
Applications of Mathematical Models in Soil Physics

Instructor: Dr. M.R. Mosaddeghi

Course description:

This course is designed to familiarize students with the applications of mathematical models in soil physics. It is to examine and understand the quantitative aspects of soil physical processes particularly in relation to the soil water retention and the transfer of energy, gas, water, solids and solutes in soil. The course begins with models, modeling, scaling and dimensional analysis of processes in a system. Mathematical description of hydraulic properties and transport processes in soils will be discussed later in detail. Computer sessions will provide students an opportunity to become familiar with the Windows-based RETC, ROSETTA, STANMOD (CXTFIT) and HYDRUS software packages.

Table of Contents:

Scientific references:

A) Books:

1) Langhar, H.L. 1980. Dimensional Analysis and Theory of Models. Krieger Publishing Company, ISBN-10: 0882756826, 166pp.

2) Campbell, G.S. 1985. Soil Physics with BASIC, Transport Models for Soil-Plant Systems. Elsevier, Amsterdam, Netherlands.

3) van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC Code for Quantifying the Hydraulic Functions of Unsaturated Soils. U.S. Environmental Protection Agency, EPA/600/2-91/065, Washington, DC. 29. 81pp.

4) Kirkham, D., and W.L. Powers. 1972. Advanced Soil Physics. Wiley-Interscience. 534pp.

5) Jury, W.A., and R. Horton. Soil Physics. Sixth Edition. John Wiley & Sons, Inc.

6) Hillel, D. 1998. Environmental Soil Physics. Academic Press, NY.

7) Koorevar, P., G. Menelik, and C. Dirksen. 1983. Elements of Soil Physics. Developments in Soil Science 13, Elsevier, Amsterdam.

8) Warrick, W.A. 2003. Soil Water Dynamics. Oxford University Press.

9) Šimůnek, J., M. Šejna, H. Saito, M. Sakai, and M. Th. van Genuchten. 2008. The Hydrus-1D Software Package for Simulating the Movement of Water, Heat, and Multiple Solutes in Variably Saturated Media, Version 4.0, HYDRUS Software Series 3, Department of Environmental Sciences, University of California, Riverside, California, USA, pp. 315.

10) Radcliffe, D., and J. Šimůnek. 2010. Soil Physics with HYDRUS: Modeling and Applications, CRC Press, Taylor & Francis Group, ISBN-10: 142007380X, ISBN-13: 9781420073805, pp. 373.

B) Journals:

1) Soil Science
2) Soil Science Society of America Journal, SSSAJ (Former: Soil Science Society of America Proceedings, SSSAP)
3) Ground Water
4) Water Resources Research
5) Transport in Porous Media
6) Journal of Contaminant Hydrology
7) European Journal of Soil Science (Former: Journal of Soil Science)
8) Advances in Water Resources
9) Geoderma
10) Australian Journal of Soil Research
11) Canadian Journal of Soil Science
12) Vadoze Zone Journal
13) Journal of Environmental Quality
14) Journal of Hydrology