Advanced Soil Physics - SOIL.7110
2012/2013 Course Outline

INSTRUCTOR: Dr. Wole Akinremi

A) Introduction 1 - Brief mathematical Reviews
- Conceptual Models
- Derivatives and integral
- ODE, PDE, Solution of differential equation
- Definite integral, indefinite integrals
- Analytical solution, numerical solution
- Boundary conditions, initial conditions

B) Chemical Thermodynamics - 1st and 2nd Laws
- Basic definition of system and thermodynamic variables.
- Thermodynamics of soil water
- Vapor Pressure Surface Tension and Capillarity

C) Soil moisture measurements - Classical and Current technology

D) Movement of water in the soil - Darcy=s law
1) Saturated Flow
2) Unsaturated Flow
3) Water movement in 1, 2 & 3 dimension
4) Infiltration of Water into the soil

E) Convective-Dispersive Equation of Chemical Transport

F) Soil heat transfer

G) Simulation models - HYDUS, LEACHMN, SHAW AND DNDC

H) Soil Spatial Variability

ACADEMIC DISHONESTY

Assignments and class presentations are expected to be the independent work of each student. The General Academic Regulations and Policy, as outlined in the 2012-2013 General Calendar (pages 24-36), will be followed in case of academic dishonesty and plagiarism.

Course Evaluation Scheme

Assignment 1 - Analytical and numerical solution of mathematical formulation. **- 5%**

Assignment 2 - Detailed review paper and class presentation on methods of measuring soil water content - **(15% = 10% written, 5% oral)**

Assignment 3 - Comparison of hydraulic and conductivity functions, their strength and weaknesses with examples of their success in modelling water movement - **(15% = 10% written, 5% oral)**

Assignment 4 - Compare and contrast any two of these simulation models: LEACHMN, SHAW, DNDC and HYDRUS-1D - **(20% = 15% written, 5% oral)**

Final examination - 45%

Except for assignment 1, all assignments involve a written paper (5-10 pages and a class presentation on the assigned topic. Marks are assigned to both written and oral presentations as shown above.

Recommended Texts

1. Environmental Soil Physics (2000) - D. Hillel.
2. Advanced Soil Physics (1972) - Kirkham and Powers.
3. Soil Physics Companion (2002) - A. Warrick (Editor).
4. Soil Water Interactions (1988) - Iwata, Tabuchi and Warkentin.
5. Fundamentals of Soil Physics - Daniel Hillel - Academic Press.
6. Soil Physics - (Sixth Edition) - W.A. Jury, and Robert Horton - John Wiley & Sons.
7. Soil Physics with Hydrus - Radcliff and Simunek
8. Soil Physics With Basic (1985) - G.S. Campbell.
9. Applied Soil Physics (1992) - R.J. Hanks.
10. Soil Physics (3^{rd} edition) - T.J. Marshall, J.W. Holmes, and C.W. Rose - Cambridge University Press.