

# HWRS 505: Vadose Zone Hydrology

Lecture 18  
10/24/2024

Today:  
Review for midterm oral exam

# Midterm Arrangement

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**Date:** Oct. 31 (Thursday)

**Location:** Harshbarger 318C

## Time slots:

10:30 – 10:45	Renad Alsufyani
10:45 – 11:00	Marleigh Chidester
11:00 – 11:15	Shujie Guo
11:15 – 11:30	Tong Guo
11:30 – 11:45	Marcy Nadel
11:45 – 12:00	Dominic Self
12:00 – 12:15	Nathan Strom

## Note on the format:

- Each of you will be asked 3 to 4 questions. In some cases, a question may include a couple of sub-questions that logically build up towards the final question.
- Make sure you understand the question before answering it. If you feel you do not understand the question, please ask for clarification.
- Try your best to demonstrate your **thought process** and **the line of reasoning**. They are much more important than the final answer.
- Like any face-to-face “exams”, it is common and OK to be stressed. Just make sure that you have a laser focus on the things you are doing, NOT the consequences.

# Review for Midterm

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- The concept of vadose zone
- Steady-state saturated flow: Darcy's law; permeability; hydraulic conductivity.
- Transient saturated flow: Deriving the governing equation (3D groundwater flow)
- Solute transport under saturated flow: Advection, mechanical dispersion, molecular diffusion.
- Air-water system: Interfacial tension; wettability; capillary pressure; bundle of tubes model (triangular vs. cylindrical).
- Macroscopic descriptions of two-phase systems:  $p_c$ - $s$  (SWC);  $k_r$ - $s$ . Mathematical descriptions of these curves (VG, BC). The idea of scaling (Leverett-J function and Miller-Miller scaling).
- Two-phase flow: two-phase extended Darcy's law; governing equations; unknowns vs. # of equations.
- Unsaturated flow: Richards' assumption; Richards' equation (different forms).
- Steady-state unsaturated flow: physical understanding; numerical solution; impact of heterogeneity.
- Transient unsaturated flow: water infiltration models; physical understanding; numerical solution; impact of heterogeneity.