ES476/576 Hydrology Final Study Guide Winter 2008

Exam Format: *Similar to Mid-Term.*

Part 1 - Lecture Exam: closed book exam, short answer, essay, terms, definitions (make sure you know how to sketch relationships).

Part 2 - Lab Exam: Equation lists, conversion charts, and calculators accessible (but not entire note books)

Key Terms and Concepts

Flood Frequency Analysis

Review the Following Class Web Documents:

Overview of Flood Frequency Analysis: (http://www.wou.edu/las/physci/taylor/hydro/Flood_Frequency.pdf)

Glossary of Terms Used in Flood Frequency Analysis: http://www.wou.edu/las/physci/taylor/hydro/flood_freq_terms.pdf

Summary of Surface Water Equations: http://www.wou.edu/las/physci/taylor/hydro/swatreq.pdf

Acre-foot
Discharge
Drainage Basin
Exceedence Probability
Frequency Factor Table
Gaging Station
Hydrograph
K Values
Log-Normal Distribution
Normal Distribution
Peak Discharge
Annual Discharge
Average Annual Discharge
Unit Discharge
Period of Record
Rating Curve
Recurrence Interval
Return Period and Exceedence Probability
Skewness
Skewness Coefficient
Standard Deviation
Streamflow (Discharge
Streamgaging
Variance
Water Year
Watershed Divide

Intro to Groundwater

Physics Review (know units and be able to calculate / define the following):
- potential energy
- kinetic energy
- force
- work
- weight
- density
- specific weight
- pressure

Groundwater
- defined
- meteoric
- connate
- juvenile

porosity
- intergranular
- primary
- secondary
- fracture
- vesicular

effective porosity
- hygroscope water
- pendular water

porosity vs. lithology / material
specific yield
specific retention
hydraulic conductivity
- permeability
- Darcy's Law

diagram darcy's law
hydraulic gradient
vertical conductivity
lateral conductivity
permeability vs. lithology / material
pH - defined, calculated
aquifers
recharge
vadose zone
phreatic zone
water table
groundwater flow
cone of depression
drawdown
unconfined aquifer
confined aquifer
aquitard
aquiclude
capillary zone
atmospheric pressure
potentiometric surface
hydraulic contours
groundwater flow directions
- upgradient
- downgradient

transmissivity
storativity
specific storage
isotropic vs. anisotropic
Groundwater issues

water resource
water budget
contamination
pumping / recharge
Wells
pumping well
injection well
static water level
cone of depression
permeameter
Darcy's Experiment
water table
potentiometric surface
confined
unconfined
artesian
free-flowing artesian
groundwater map
groundwater flow net
equipotential lines

Well Hydraulics

Monitoring Well
Pumping Well
Observation well

know what a well installation looks like (be able to sketch it)

drill rig
hollow stem auger
well screen
well riser
well diameter
static water level
pumping water level
well recovery
drawdown
residual drawdown
cone of depression
saturated thickness
recovery curve
slug test
pump test
radial flow
transmissivity
storativity
hydraulic gradient
aquiclude
aquitard
leaky confined aquifer
static water level
depth to water
water table elevation
upgradient
downgradient
groundwater flow vectors
fractured aquifer
porous medium
aquifer skeleton

Groundwater Flow

Advection
Retardation
hydraulic conductivity
pumping rate
well radius
well distance
partial penetration
leaky aquifer
slug test

Surfer Software

x,y,z data
digital map
shaded relief map
vector map
contour map
surface map
grid file (*.grd)
*.srf file
drawing tools
import
DEM
USGS DEM
gridding data
kriging
inverse distance
triangulation
map scale
interpolation
digitizing

Aqtesolv

hydrostatic pressure
atmospheric pressure
kinetic energy
potential energy
fluid pressure
total energy equation
hydraulic head
piezometer
hydraulic gradient
groundwater flow vectors
Darcy's Law
Darcy's Flux
Seepage Velocity (linear velocity)
hydraulic gradient
groundwater flow line

pumping test
slug test
pumping rate
visual curve matching
automatic curve matching
displacement data
time data
observation well
pumping well
saturated thickness
drawdown
casing radius
match menu
view menu
consistent units
solution types
theis method
cooper jacob method
hantush-jacob method

Lab Skills to Focus On for Final

Can you perform simple and complex unit conversions?

Do you understand dimensional analysis and unit algebra?

Do you know how to manage positive and negative exponents with respect to unit algebra?

Can you perform the following quantitative skills from the first lab:

plotting a graph (log-log plots, semi-log plots, arithmetic plots, log cycles, log base-10)
re-arranging equations
solving for unknown variables in an equation
manipulating exponents and bases
convert between metric and english systems of measurement
calculate the equation for a line from a graph
calculate the slope of a line
write an equation if given a description of a quantitative problem
convert between degrees and radians when dealing with angular measurement

Do you know how to use MS Excel as an analytical tool with respect to hydrologic data (data input, graphing, caculating, sorting, etc.... all the tricks we learned in lab)

Can you perform the following quantitative skills from the second lab:

determine volumes of water in a reservoir
calculating rates of discharge, evaporation and input into a hydrologic system
converting between various measures of area, length, volume, and discharge
determine the total input and withdrawl from a simple hydrologic system (calcuating water budgets)
determine the discharge of runoff using weirr techniques
calculate the volume of lake water using the frustrum of a cone

Can you perform the following quantitative skills from the contouring exercises

draw contour lines on rainfall data? draw contour lines on groundwater elevation data?
- identify contour intervals and interpolate between data points

Can you perform the following quantitative skills from the intro groundwater problem set (set 1)?

calculate: weight, force, density, specific weight as applied to water
- solve for the variables in Darcy's law
- determine hydraulic conductivity from a set of given values
-calculate transmissivity of an aquifer
-draw a groundwater contour map and draw generalized groundwater flow lines
- determine the pH of water
Can you calculate hydraulic gradient from a groundwater contour map

Can you use the following software to solve a problem:

Excel
Aqtesolv
Surfer

How about the problems from Groundwater problem set two.
Check out the answer keys and make sure you can work the problems and tutorials for the following labs:

Groundwater Problem Set 1 (Introduction to Groundwater)
Groundwater Problem Set 2 (Groundwater Flow)
Digital Mapping / Surfer Exercises
Introduction to Surfer Tutorial Exercise
Applications of Surfer to Groundwater Hydraulics
Well Hydraulics / Aquifer Testing Exercise

Other Stuff I've Thought of...
how is the saturated thickness of the aquifer affected by pumping in a confined vs. unconfined aquifer?

What is the difference between a confined and unconfined aquifer, how do you know which is which in the groundwater environment?

What is the difference between a slug test and pump test? What types of data are collected in each? How is the data analyzed?

What is the shape of the cone of depression in a high vs. low transmissivity aquifer?

Can you sketch a scenario if given well geometry and aquifer configuration?