ES476/576 Hydrology Final Exam Study Guide Winter 2018

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). Suggestion, organize diagrams and equation lists by topic, so that you can easily find and use your tools on the open-book portion of the exam.

Recommended Study Techniques:

Memorize / study key words and concepts from class notes (focus on yellow highlight words below)
Review/watch class video resources (Youtube resources on drilling, well installation, aquifer testing)
Complete all lab exercises / review answer keys before exam
Read over textbook chapters on Moodle Class Site

KEY TERMS AND CONCEPTS

Willamette 2100 Poster Project

http://www.wou.edu/las/physci/taylor/es476_hydro/ES476_Winter2018_Poster_Project_Summary.pdf

Climate Models:
climate
Drainage Efficiency:
Vegetation
Water Policy

rain vs. snow,
temperature
timing of precipitation,
total precipitation,
vegetative growth

cycles vs. seasonal precipitation patterns,

snow/rain mix according to elevation
Mediterranean climate
Dry/wet seasons
Drought risk
Snow ablation
Albedo
Black body absorption
Growing season
Irrigation management
Snow melt predictions
Maritime snow / snow pack
Climate simulation
Envision Model
Water resource vulnerability
Water supply-demand
Stable oxygen isotopes
Catchment tracers
Transit time model
Snowmelt –runoff model
Forest cover
General circulation model
Water balance
Evapotranspiration
Plant uptake / ecophysiology
Fire-snow cycles

Surface Water Hydrology

http://www.wou.edu/las/physci/taylor/es476_hydro/surfwatr.pdf

drainage basin
watershed
drainage divide
interfluve
groundwater-surface water
discharge
drainage area
cross-sectional area
flow velocity
channel width
channel depth
volume/time
continuity equation Q = VA
stream lengths
drainage density
shreve magnitude
stream ordering
1st order, 2nd order, etc.
peak discharge
peak annual flow
peak monthly flow

Groundwater Key Word Search

http://www.wou.edu/las/physci/taylor/es476_hydro/groundwater_key_word_search_exercise.pdf

Aquifer
Aquiclude
Porosity
Permeability
Saturated vs. Partially saturated
Aquifers
Pore pressure
Capillary force
Darcy's Law
Permeameter
Hydraulic conductivity
Intrinsic Permeability
Darcy's velocity
Isotropic vs. anisotropic conductivity
Matric potential
Vadose zone
Infiltration capacity
Wetting front
Capillary fringe
Base flow
Confined aquifer
Unconfined aquifer
Unsteady vs. steady flow

Hyporheic zone
Effective porosity
Yield porosity
Macro porosity
Saturated front
Water table
Potentiometric surface

Intro to Groundwater Notes
http://www.wou.edu/las/physci/taylor/es476_hydro/gwater1.pdf

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
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
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
http://www.wou.edu/las/physci/taylor/es476_hydro/gwflow.pdf

Groundwater Contour Maps
hydrostatic pressure
atmospheric pressure
kinetic energy
potential energy
fluid pressure
hydraulic head
piezometer
hydraulic gradient
groundwater flow vectors
Darcy's Law
Darcy's Flux
Seepage Velocity (linear velocity)
groundwater flow vectors
equipotential lines

Drilling Techniques KeyWords
http://www.wou.edu/las/physci/taylor/es476_hydro/driscoll_well_drilling.pdf

- Hollow stem auger
- Cable tool drilling
- Air rotary drilling
- “Casing”
- “Well Screen”
- Split spoon
- Blow counts
- Shelby tube
- Grout
- Slotted screen
- Riser pipe
- Sand pack
- Tri-cone rotary bit
- Well log
- Drillers log

Well Installation / Hydraulics

Notes

http://www.wou.edu/las/physci/taylor/es476_hydro/Sterrett_2007_well_construction.pdf

Total depth
Bore-hole diameter
Annular diameter
SWL
TD
Stick-up
Static water level
DTW
Depth to water
Datum
Hydraulic head

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

hydraulic gradient
drill rig
hollow stem auger
well screen
well riser
well diameter
static water level
pumping water level
well recovery
drawdown
groundwater contours
cone of depression
groundwater flow lines
hydraulic conductivity
pumping rate
Pump Test
Pumping Well
Observation Well
Cone of Depression
Drawdown-recovery curve
K = Hydraulic Conductivity
T = Transmissivity
S = storativity / storage coefficient

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
- re-arranging equations
- solving for unknown variables in an equation
- manipulating exponents and bases
- convert between metric and english systems of measurement

~~Ice Budget balance problems~~

~~Recurrence Interval / Flood Frequency Problems? Rational runoff hydrology problems?~~

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)

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
- Can you calculate hydraulic gradient from a groundwater contour map

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)
- Groundwater contouring Exercises
- Well Log Interpretation
- Applications to Groundwater Hydraulics

Key Groundwater Equation Summary (problem focus for exam):
Work Transmissivity

Force
Weight
Pressure
Density
Porosity
Permeability
Specific Yield
Specific Retention
Darcy's Law / Permeameter Equations
Storativity
Hydraulic Gradient
Darcy's Flux (Q)
Seepage Velocity
Well Drawdown
Well Yield
Well Specific Capacity

Stream discharge
Continuity equation
Probability/recurrence interval equations
Interpreting flood hydrographs
What is the difference between a stream rating curve and a flood frequency curve?