Lock Haven University
GEOS 360 – Hydrogeology
Study Guide for the Final Exam

The final exam is cumulative. Consult two study guides from earlier tests for the cumulative part of the exam. There will be 10 definitions (5 points each), two short-answer questions (10 points each), and an essay question (30 points) in the test. You will not have to write any equation, unless you want to use them to shorten your explanations, but sketches, maps, and other illustrations will be helpful in answering some of the questions.

Know the following terms:

Theis equation, Theis Type Curve, Well Function, drawdown, Cooper-Jacob's method, Leakance, Hantush-Jacob method, steady state flow, bentonite packing, purging well, drilling log, casing and screening of well, static water level, data logger (Mini Troll), nest of piezometers, seepage velocity, superposition of drawdown, image well, recovery test, step pumping test, specific capacity, slug test, packer test, cone of impression, impervious boundary vs. recharge boundary, groundwater models, calibration of models, sensitivity test, finite-element model, finite-difference model, AQTESOLV, GMS, MODFLOW, variable grids, advection, dispersion, dispersivity, retardation coefficient, Fick's Law of mass transport, diffusion,Clean Water Act, maximum contaminant level (MCL), beneficial uses, volatile organic compounds (VOC), LNAPL, DNAPL, BTEX, chlorinated solvents (TCE, PCE), point vs. non-point sources of pollution, pump and treat, bioremediation, permeable barrier.

Short answer questions:

** What is the well theory based on? What are some assumptions behind the well theory? How realistic are those assumptions?

** What is the Theis Equation? Why is it considered another fundamental principle of GW flow? How can it be used to determine T, and S. What steps are involved in using Theis' Equation to determine formation constant or aquifer parameters?

** How does the Cooper-Jacob's method vary from Theis method of determining aquifer properties? Which is (Theis or Cooper-Jacob) a better methods? Why? What steps are involved in using the Cooper-Jacob's methods to determine aquifer parameters for a time-drawdown and distance-drawdown method?

** What is the contribution of Hantush-Jacob to well theory? Under what circumstances or aquifer conditions is this modification applied?

** Know the Principle of Superposition of drawdown and its applications and importance in understanding recovery of water table, results or prediction of step pumping, and recharge and discharge boundaries.

** What is a slug test? What is packer test? How are they different? What are some pros and cons of slug test and packer test? Know different types of slug tests and their similarities and differences.

** What is groundwater modeling? What types of models are used to simulate GW flow characteristics? What are some pros and cons of these models? How is MODFLOW different from WELFLO or other models?

** Why do we need GW models? What data do you need to develop models? What steps (model protocol) are involved in developing models?

** What are some uses of modeling? How does GW flow models vary from solute transport models? What are some limitations?

** What the major solute and/or contaminant transport processes? How are they related to each other? What are some importance and implications (with examples) of these processes?
** What are the categories, frequency of occurrence, and priority ranking of groundwater pollution? What are some common sources of groundwater?
** What the most commonly used remediation techniques/methods in treating contaminated groundwater and soil?
** What is BMP? What are some specific examples of BMPs in agriculture that might help improve water quality in a watershed?

The essay question: you will have to be able to synthesize information from various topics to answer this question. To best answer this question, formulate an outline in your head before you attempt to elaborate. At the very least, you should have a bulleted outline that summarizes your thoughts on the topic. Keep in mind that your answer should incorporate as much concepts and theories of hydrogeology as possible (after all you are writing this essay for a Hydro class!)