STUDY TOPICS FOR HYDROLOGY FINAL

Snow, hydrologic importance of snow
Material characteristics of snow: depth, porosity, density, liquid water content, Snow Water Equivalent (SWE)
Measurement of snow & snowmelt, distribution of snow, snowmelt processes, snowmelt prediction

Soil water
Measurement/quantification of soil particles and structure
Porosity, effective porosity, permeability, Bulk density
Saturated vs. unsaturated soil, hygroscopic water
Volumetric water content
Infiltration rate

Gravitational forces vs. tensional forces
Surface tension due to adhesion and cohesion
Small pores fill first, larger pores empty force, this leads to hysteresis
Field capacity
Movement of soil water is due to soil water tension (not soil water content), so dry-to-wet movement can happen
Upward movement of soil water due to ET and suction by plants through roots
Concept of wilting point and plant available soil water
Factors that affect water movement in and through soils: Soil texture/structure/depth/layering, compaction, organic matter, soil fauna, hydrophobicity, antecedent soil moisture, frozen soil, vegetation & residue, macropores, surface detention, water viscosity & quality, urbanization, time
Soil water balance
Infiltration capacity

Hydraulic head and energy concepts related to groundwater flow
Equipotential lines, flow lines
Dependence of groundwater flow rate on hydraulic gradient, cross-sectional area, hydraulic conductivity; Darcy equation
The importance of the value of hydraulic conductivity, and the magnitude of the range of this variable
Unconfined vs. confined aquifers, water table, artesian wells
Effects of pumping (cone of depression), gaining vs. losing streams

Importance of runoff and subsurface drainage concepts to civilization
Runoff processes (Hortonian, Saturation overland), variable source area concept
Watershed factors that affect runoff
Examples of changes to hydrographs with differences in watershed factors
Hydrographs, hydrograph shape/parts, and hydrograph separation into baseflow/stormflow

Open channel flow, Flow velocity and Discharge (at a cross-section): Q=AV
Manning’s equation and the meanings of its various terms:
hydraulic radius, slope, manning’s n, wetted perimeter, cross-sectional area
Measuring Q at a cross-section
Stream gaging, rating curves
Floodplain modeling
Introduction to fluvial geomorphology: stream networks, origins of meandering and braiding, at-a-station and downstream hydraulic geometry

Dams and Dam Nation
Reasons dams are built, the various uses for dams
The history of dam building in the US, and the related history of effects on US rivers