AOM 3734: Irrigation Principles and Practices in Florida

Assignment #1:

Exam Hint: There will be only 4 calculations questions on the test, but they may be parts or composites of these questions. Remember, on the test, everything written will receive some partial credit. Answers will be posted in a week, and will go over them in class.

Part 1 – Understanding Evapotranspiration

1. What is the difference in actual evapotranspiration from midseason sweet corn grown under low humidity and strong windy conditions (15 mph or 360 mpd) as compared to midseason sweet corn grown under high humidity and strong conditions (15 mph or 360 mpd)? Assume a Class A evaporation pan is surrounded by 350 ft of green grass in all directions and has an average of 10 inches of evaporation per month.

2. What is the difference in actual evapotranspiration from midseason sweet corn grown under high humidity and strong windy conditions (15 mph or 360 mpd) as compared to midseason peanuts under high humidity and strong windy conditions (15 mph or 360 mpd)? Assume a Class A evaporation pan is surrounded by 350 ft of green grass in all directions and has an average of 10 inches of evaporation per month.

Exam Hint: These are basically the same question. (15 points)

Part 2 – Understanding Soil Properties and Soil Moisture

A 98.2 cubic centimeter (cc) sample of soil was taken from Tallahassee, Florida, 5 cm below the soils surface. The sample was determined to weigh 193 grams. The sample was dried, and it reweighed at 162 grams.

3. What was the volume of water in the sample (assume waters density is 1.00 g/cc)?

4. What was the volume of the solid fraction of the sample (assume a soil particle density of 2.65 g/cc)?

5. What was the bulk density of the sample? What was the porosity of the sample?

6. What was the both the gravimetric and the volumetric moisture content of the sample?
7. Compare the volumetric moisture content of the sample with its porosity.

8. This is very comparable to Lakeland fine sand (surface soil). If it was measured, what would have been the soils pressure head (soil moisture potential, use Figure 27 in the class notes)? Was the sample above or below field capacity? Was the sample above or below the permanent wilting point?

9. What is the soil classification of the sample if it is composed 88% sand and 7% silt?

   Exam Hint: Usually, this question aims at calculating the volumetric water content and comparing it to the porosity. (30 points)

Part 3 - Understanding Basic Hydraulics

10. Calculate the friction loss in 1000 ft section of 6-inch Schedule 40 IPS PVC pipe (OD = 6.625 in; WT = 0.280 in; ID = 6.065 in) operating at 600 gpm.

11. Calculate the total friction loss in the same pipe with 20 equally (50 ft) spaced outlets along its length.

12. Calculate the minor loss through a 6-inch diameter (ID = 6.25 in) gate valve and a 6-inch diameter (ID = 6.25 in) butterfly valve flow rate is 600 gpm.

13. What is the total friction loss if 600 gpm went through the gate valve then the butterfly valve and finally entered the 6-inch lateral with 20 equally spaced outlets?

14. The valve are supplied with 600 gpm at 65 psi, what is the system head before the valves, assume the elevation at the valves is zero and a 6-inch diameter PVC pipe (ID = 6.065 in) before the valves?

15. Note the velocity through the valves and the first exceeds 5 fps, how could one decrease the velocity at the beginning while decrease the overall cost of the lateral?

   Exam Hint: Identify the flow in and flow out of two pipes, the velocity in one pipe (not directly above, but indirectly) and Hazen-Williams friction loss in the same pipe. (35 points)

Part 4 – Understanding Water Measurement

16. What would be the head on a 90° V-notch Weir with a maximum flow rate 6.85 cfs?

17. What would be the crest length of a contracted rectangular weir with a maximum flow rate 6.85 cfs, and a maximum allowable head of 0.6 ft?
18. What is the AVERAGE VELOCITY in an open channel, the slope is 0.01 ft/ft, the flow depth is 2 ft, channel width is 3 ft, and the Manning’s roughness coefficient, n, is 0.025 (assume a rectangular cross-section)?

19. What is the FLOW RATE in an open channel, the slope is 0.01 ft/ft, the flow depth is 2 ft, channel width is 3 ft, and the Manning’s roughness coefficient, n, is 0.025 (assume a rectangular cross-section)?

*Exam Hint: One of these, with little to no change. (20 points)*