

Homework Assignment 2

1. A sharp-edged cylinder 15 cm in diameter is carefully driven into the soil so that negligible compaction occurs. A soil column 20 cm in length is secured. The wet weight is 5780 g and the dry weight is 5180 g. What is the percent moisture on a dry weight basis? What is the bulk specific weight of the soil?
2. A completely saturated clay soil has a soil moisture fraction of 40.0% and a bulk density of 1.34 g/cm³. Determine the porosity and the specific gravity of the clay particles.
3. Later, after noticeable compaction of this clay soil, an undistributed soil sample was again taken into the laboratory. The measured bulk density was 1.84 g/cm³. Determine the porosity. Then determine the soil moisture when $S = 0.85$.
4. For the following data, calculate the total available water and the soil moisture deficit.

Soil Depth (cm)	Bulk Density	W _{fc}	W _{wp}	W
0-15	1.25	0.24	0.13	0.16
15-30	1.30	0.28	0.14	0.18
30-60	1.35	0.31	0.15	0.23
60-90	1.40	0.33	0.15	0.26
90-120	1.40	0.31	0.14	0.28

5. Soil samples were collected at the site of a field to be planted in grass. Laboratory measurements showed the average field capacity, W_{fc} , to be 24%, while the average value of the permanent wilting point measurements was $W_{wp} = 11\%$. Three field measurements of bulk density were made, with the results being 1.42, 1.51, and 1.45. If the grass that will be planted is estimated to have a potential effective rooting depth of 53 cm, what would you estimate the total available water to be in the root zone in millimeters? At what soil moisture content, W , would an irrigation event be scheduled if $MAD/TAW = 0.55$?
6. From previous experience on a particular field, it is known that the average volumetric moisture content in the root zone depth of 650 mm will correspond quite reasonably with a volumetric moisture content of 0.38 three days after completing an irrigation event. The daily evapotranspiration is 8 mm during the hottest month of the season. During this period, what will be the average volumetric moisture content 2 weeks after completing an irrigation event? If the management allowed deficit is 75 mm, what is the required interval between irrigation events during the hottest month?

7. Water balance studies were conducted on a 6-ha field for 3 years. The data are summarized below for each year.

<i>Year</i>	<i>D_a (mm)</i>	<i>D_{tw} (mm)</i>	<i>D_p (mm)</i>	<i>D_{et} (mm)</i>	<i>EC_z (μmho/cm)</i>	<i>D_{pz} (estimated)</i>
2524	1470	845	625	635	1500	0.5D _p
2525	920	435	205	670	2450	1.0D _p
2526	1285	710	520	685	2100	0.6D _p

For each year, what value of EC_{dp} is required to maintain a salt balance? Assuming 1 mg/l = 0.64*EC μmhos/cm, how many metric tons of salt must be leached from the root zone during this 3-year period in order to maintain a salt balance? What is the average salt concentration in mg/liter in this leachate over the 3-year period assuming that a salt balance occurs?

8. A 16 ha field is used to grow two crops annually, with the average seasonal crop evapotranspiration being 725 mm and 450 mm for each crop. The total available irrigation water supply is 0.247 million cubic meters, with all of the tailwater runoff being recycled. This water supply has a total dissolved solids (salts) concentration of 1300 mg/liter. If the subsurface drainage flows have a salt concentration of 3700 mgg/liter, is a salt balance being maintained? Calculate the volume of excess or accumulated salts in metric tons per year.
9. A basin having an area of 0.12 ha is irrigated for 2 hours with a water supply of 30 liters/s. Prior to this irrigation event, the soil moisture deficit, SMD, was 130 mm. Assuming that the soil moisture deficit is completely replenished in the basin (Er = 1.0), what is the application efficiency and deep percolation ratio for this irrigation event?
10. A furrow-irrigated set consists of 27 furrows spaced 30 in. apart with a furrow length of 1320 ft. At the time that the irrigation event was begun, the soil moisture deficit was 110 mm. Each furrow had an inflow of 13 gal/min for 24 h. The distribution of infiltrated water depth along the furrow length is as follows:

Furrow length, l/L	.05	.15	.25	.35	.45	.55	.65	.75	.85	.95
Infiltrated depth (mm)	158	153	148	142	136	129	121	110	95	76

What is the volume of deep percolation and tailwater runoff in acre-feet and cubic meters? What is the value of DU, Ea, Er, DPR and TWR for this irrigation event?