Water Resources Engineering Lecture 6

Midterm Review Session

Dr. Zada Tawalbeh

Ajloun National University

Exams Materials

- Lecture1_Water_Resources_Engineering_Introduction
- Lecture2_Hydrologic Processes_Precipitation_Mays
- Lecture3_Evaporation_ET_Mays
- Lecture4_RH_Evapo_ET calculation_Infiltration

Multiple Choice Questions

1. **Which process controls the initial movement of rainfall into the soil?**
   A) Runoff
   B) Infiltration
   C) Evaporation
   D) Baseflow
2. **Which tool provides areal rainfall measurements?**
   A) Rain gauge
   B) Radar
   C) Satellite
   D) Lysimeter

3. Streamflow in rivers is measured using:

A) Radar

B) Current meters or Flowmeter

C) Soil cores

D) Penman–Monteith method

4. Which factor increases infiltration?

A) Compacted soil

B) Dry sandy soil

C) Steep slope

D) High-intensity rainfall

5. Which factor decreases infiltration rate?

A) Less vegetation cover

B) Loose sandy soil

C) High soil compaction

D) Soil dryness

6. Evapotranspiration is highest when:

A) Humidity is high

B) Solar radiation is high (Sun)

C) Soil is frozen

D) Wind speed is zero

7. Which method provides the most spatially continuous precipitation data?
A) Rain gauge
B) Radar
C) Tipping bucket gauge
D) Soil probe

8. Runoff begins when:
A) Infiltration capacity is greater than rainfall intensity
B) Rainfall intensity exceeds infiltration capacity
C) Water table is low
D) Soil is dry

9. Which factor does not increase evapotranspiration?
A) High temperature
B) Strong wind
C) Cloudy weather
D) Low relative humidity

10. Which process decreases when the soil becomes fully saturated?
A) Runoff
B) Percolation
C) Infiltration
D) Evapotranspiration

11. The hydrologic cycle is driven mainly by:

A) Soil type

B) Solar energy (Sun)

C) Wind speed

D) River discharge

The previous questions cover the first two lectures

Multiple Choice Questions

1. **Which type of precipitation occurs when moist air is forced to rise over a mountain range?**
   A) Convectional
   B) Orographic
   C) Cyclonic
   D) Frontal

2. **Which method assumes all rainfall gauges have equal weight?**
   A) Thiessen Polygon Method
   B) Isohyetal Method
   C) Arithmetic Mean Method
   D) Radar Method

3. **In the Thiessen Polygon Method, rainfall at a point is assumed to be:**

A) The average of all gauges

B) Equal to the nearest gauge

C) Based on contour interpolation

D) Measured by radar

4. Evaporation rate increases when:

A) Relative humidity is high
B) Temperature is low
C) Wind speed is high
D) Air pressure is high

5. **Under similar weather conditions, which evaporates more slowly?**

A) Freshwater
B) Ocean water
C) Soil water
D) Rainwater

6. **Pan evaporation from a water body is calculated using:**
   A) $EP = K \times EL$
   B) $EL = K \times EP$
   C) $EL = EP - K$
   D) $EL = EP / K$

7. Which factor reduces the rate of evapotranspiration?
   A) High sunshine hours
   B) High wind speed
   C) Low soil moisture
   D) High humidity

8. **Relative humidity reaches 100% when:**
   A) Evaporation stops
   B) Air becomes saturated
   C) Temperature drops to zero
   D) Wind speed reaches a maximum

9. Which instrument is used to directly measure evapotranspiration?
   A) Lysimeter
   B) Rain gauge
   C) Hygrometer
   D) Radar

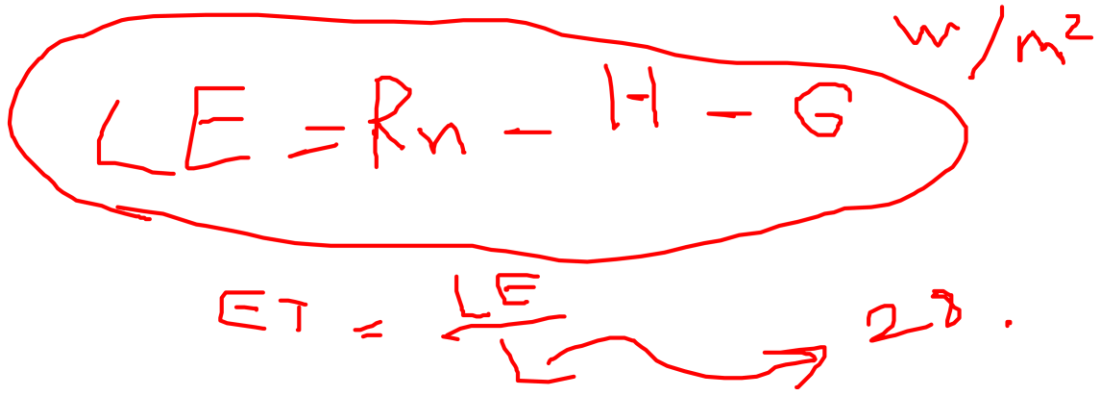
10. **Which of the following is *not* a component of the energy balance equation used to estimate evapotranspiration?**

a) Net radiation (R_n)

b) Sensible heat flux (H)

c) Ground heat flux (G)

d) Moisture content



True/False

1. Evapotranspiration decreases when temperature increases (True/False).

2. Infiltration rate is always constant during a storm event (True/False).

3. Relative humidity increases when the air temperature rises (True/False).

4. If RH = 100%, the air is fully saturated and condensation may occur. (True/False).

5. Evapotranspiration represents the combined process of evaporation from soil and transpiration from plants. (True/False).

6. Actual vapor pressure represents the maximum amount of moisture the air can hold (True/False).

7. Evaporation increases when air temperature increases (True/False).

8. High relative humidity leads to a higher evaporation rate (True/False).

9. Wind speed has no significant effect on the rate of evaporation (True/False).

10. A storm hyetograph represents rainfall intensity versus time (True/False).

Example: A crop field was monitored over a 24-hour period, and the following average energy fluxes were measured:

Net Radiation (R_n) : **180 W/m²**

Sensible Heat Flux (H): **60 W/m²**

Ground Heat Flux (G): **15 W/m²**

Using the **energy balance equation**, calculate the **daily evapotranspiration (ET)** in **millimeters per day (mm/day)**.

- **Solve for Latent Heat Flux (LE)**

$$LE = R_n - H - G$$

$$LE = 180 - 60 - 15 = 105\ W/m^2$$

- **Convert LE (W/m²) to ET (mm/day)**
- $ET = \frac{LE}{L}$
- $\mathrm{L} = 1\ mm/day = 28.94\ W/m^2$

Thus:

- $ET = \frac{105}{28.94} \approx 3.63\ mm/day$

- A US Class A evaporation pan measurement over one month (30 days) shows a total water loss of **120 mm**. We use a pan coefficient of **0.7** for a nearby lake.

$$E_L = K_p \times E_p$$

- A pan measurement over one month (30 days) shows a total water loss of **180 mm**. We use a pan coefficient of **0.65** for a nearby lake.

$$E_L = K_p \times E_p$$

- **Example**
- The **Actual Vapor Pressure** $e$in the air is **12 mbar**.
  At the current air temperature, the maximum **Saturated Vapor Pressure** $e_s$the air can hold is **30 mbar**.
  Determine the Relative Humidity (RH).
- Formula:
- $RH = \frac{e}{e_s} \times 100\%$
- Substitution:
- $RH = \frac{12}{30} \times 100\% = 40\%$

- Mention three factors affecting the evaporation.
- What is Evapotranspiration?
- Mention three components of the hydrologic cycle.
- Mention the three types of precipitation