



University Of Technology
Building and Construction Eng. Dept.
Final Exam – 2013/2014

Subject :Irrigation & Drainage Eng.
Branch :Water and Dams Eng.
Examiner :Dr. Ibtisam R. Kareem

Class: Fourth year
Time : 3 hours.
Date : 7 / 6 / 2014



Note. Answer four questions only.

Q1) a- Multiple choice questions: (12 Marks).

- 1- The root zone of crops and the soil may get(acidic , alkaline , neutral) due to excessive seepage of water through canal banks.
- 2- (Gravitational , Capillary , Hygroscopic) water is held as a very thin film round the soil particle and it is unavailable to the plant except in extreme cases of drought.
- 3- Efficiency of (Water storage, Water use, Water distribution) is the ratio of the water stored in the root zone during irrigation to the water needed in the root zone prior to irrigation.
- 4- The size of basin for clays is (3 times, 10 times, 5 times) that of sand as the infiltration rate for clay is low leading to higher irrigation time.
- 5- (Intercepting , Parallel , Bedding) system is suited to flat, poorly drained soils which have numerous shallow depressions.
- 6- When the water table comes to (3.5m , 5.5m , 1.5m) below the surface of the soil , the land is said to be water logged.

b- The culturable commanded area for a distributary is 15,000 hectares. The intensity of irrigation for wheat crop is 40 % and for rice is 15 %. If the total water requirements of the two crops are 37.5 cm and 120 cm and their periods of growth are 160 days and 140 days respectively; determine the outlet discharge from average demand considerations. (13 Marks)

Q2)a- State (only) the following: (12 Marks)

- 1- Reasons of providing the free board for the irrigation canals.
- 2- Ways of reducing the effects of wind on the sprinkler irrigation system .
- 3- Four types of lands requiring drainage.

b- Calculate the balancing depth for a channel section having a bed width equal to 18 m and side slopes of 1:1 in cutting and 2:1 in filling. The bank embankments are kept 3.0 m higher than the ground level (berm level) and crest width of banks is kept as 2.0 m. (13 Marks)

Q3) a- Answer with True or False and correct the false statement: (12 Marks)

- 1- When gravitational water has been removed, the moisture content of soil is called permanent wilting point.
- 2- If the slope of the ground is steep, the irrigation water requirement will be more

- 3- The soil which is formed by the disintegration of rock formations is known as alluvial soil.
- 4- The head difference between emitters should not exceed 10 to 15 % of the average operating head for long-path or 20 % for turbulent flow emitters.
- 5- Tile drains are used for areas where water table has permanently risen very near to soil surface.
- 6- In soils having high permeability, over irrigation or flood causes water logging.

b- Design a trapezoidal channel to carry $Q = 20.25 \text{ m}^3/\text{s}$, $V = 1.5 \text{ m/s}$, $n = 0.025$, side slope $m = 2$. Assume bed width to depth ratio is 4. Also find the longitudinal slope of the channel S_0 . (13 Marks)

Q4)a- Sketch the following: (15 Marks)

- 1- A canal section in full banking
- 2- Time-Distance graph of the Basin irrigation system
- 3- Seepage drains

b- Find the lateral discharge of a sprinkler irrigation system if the distance between sprinklers is 12m, the design discharge of the sprinkler is 0.315 l/sec and the lateral length is 400m. (10 Marks)

Q5)a- Show the relationship between the followings: (15 Marks)

- 1- Mean & critical velocity of flow in the canals.
- 2- Emitter discharge & pressure head at which the emitter operates.
- 3- Cultivated land for a particular crop & total culturable command area.

b- An area of 1.5m depth (where impermeable bed exists) has a coefficient of permeability of 0.5 m/day. The rate of rainfall is 2 mm/day. Determine the spacing between any two drains which keeping the central line of each drain 1m below G.L and the water table should be 0.75m below G.L. (use Donnan's equation): (10 Marks)

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Typical solutions of irrigation & drainage eng. Exam 2014

Q1)a- a- Multiple choice questions.

- 1- alkaline
- 2- Hygroscopic
- 3- Water storage
- 4- 10 times
- 5- Parallel
- 6- 1.5m

b- For Wheat: area = $15000 * 0.4 = 6000$ hectares, $\Delta = 37.5$ cm & B = 160 days
Average duty D = $864 * 160 / 37.5 = 3686$ hectares / cumec
Outlet discharge required = $\text{Area} / \text{Duty} = 6000 / 3686 = 1.63$ cumec

For Rice: area = $15000 * 0.15 = 2250$ hectares, $\Delta = 120$ cm & B = 140 days
Average duty D = $864 * 140 / 120 = 1008$ hectares / cumec
Outlet discharge required = $\text{Area} / \text{Duty} = 2250 / 1008 = 2.23$ cumec

So the average design discharge required at outlet is 2.23 cumec (the max. value)

Q2)a-

1- Reasons of providing the free board for the irrigation canals.

- a- to keep a sufficient margin so that the canal water does not overtop the bank in case of heavy rainfall.
- b- to keep the saturation gradient much below the top of the bank.

2- Effects of Wind

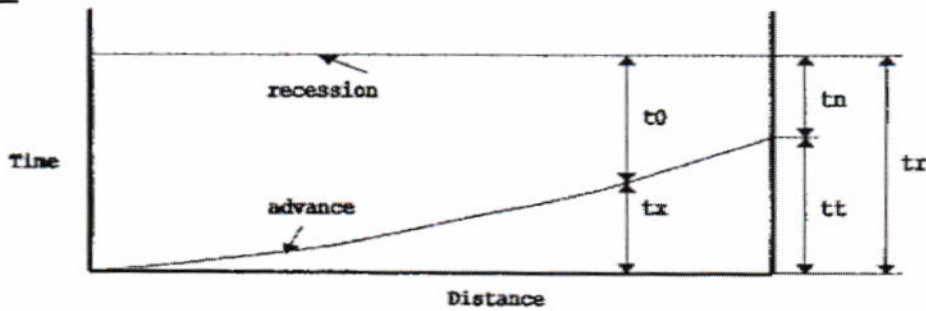
a- Reduce the spacing between sprinklers.

- b- Align Sprinkler Laterals across prevailing wind directions
- c- Build extra capacity
- d- Select rotary sprinklers with a low trajectory angle.

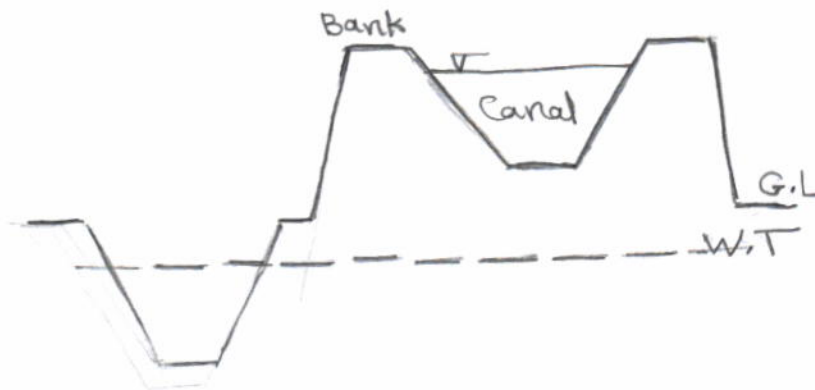
3- Types of lands requiring drainage

- a- High water table.
- b- Water standing on land surface.
- c- Excessive moisture content (above field capacity is harmful for crops)
- d- Evaporation exceeding rainfall.
- e- Humid regions.
- f- Flat lands.

2-



3-



b-

$$N = 400/12 = 33 \quad (\text{No. Of sprinklers})$$

$$Q = 33 * 0.315 = 10.395 \text{ l/sec} \quad (\text{discharge of the lateral})$$

Q5)a-

$$1- \quad V = V_o * m \quad (m \text{ is the critical velocity ratio})$$

$$2- \quad q = K h^x$$

Where: q is the emitter discharge; K is constant for each emitter ; h is pressure head at which the emitter operates and x is the exponent characterized by the flow regime.

3- Cultivated land = total culturable command area * intensity of irrigation

b- **Donnan's formula** $L^2 = 4K(b^2 - D^2)/q$

$$K = 0.5 \text{ m/day}, \quad q = 2/1000 = 0.002 \text{ m/day}$$

$$b = 1.5 - 0.75 = 0.75 \text{ m}, \quad D = 1.5 - 1 = 0.5 \text{ m}$$

$$\text{So} \quad L = 2 \sqrt{(0.5)(0.75^2 - 0.5^2)/0.002} = 17.67 \text{ m}$$