

**INSTITUTE OF LAND AND FOOD RESOURCES
THE UNIVERSITY OF MELBOURNE
DOOKIE COLLEGE**

BACHELOR OF APPLIED SCIENCE

IRRIGATION TECHNOLOGY – SAMPLE QUESTIONS

- 1 (a) What effect has land clearing, irrigation, cropping and grazing had on the water table and natural drainage system in the Murray Valley?
- (b) What measures are being instituted to cope with land degradation in these irrigation areas?
- (15 marks)
- 2 A vineyard has a rooting depth of 0.5 m and available soil water content in a loamy soil of 120 mm/m. For an allowable water depletion of 50% determine:
- (a) the irrigation application depth assuming 90% uniformity of water application
- (b) the irrigation requirement assuming an efficiency of 75% in the sprinkler irrigation system
- (c) the irrigation interval assuming average daily ET crop of 6 mm/day.
- (10 marks)
- 3 A permanent sprinkler system used for irrigating tomatoes growing in a sandy loam (available water = 120 mm/m) was tested and the following characteristics defined.
- | | | |
|------------------------------------|---|----------------|
| Sprinkler spacing | = | 10 m x 15 m |
| Individual sprinkler output (mean) | = | 25 litres/min. |
| Operating pressure of system | = | 250 kPa |
| Variation in pressure | = | + 25 kPa |
| Distribution uniformity (D.U.) | = | 70% |
- (i) What other data would you require regarding both the irrigation system and crop performance to allow you to comment fully on system performance?
- What comments could you make with the present information?
- (ii) Calculate the application rate (mm/hr)
- (iii) From this, calculate irrigation period required to replace a mean 40 mm depth of water.
- (10 marks)
- 4 (a) A 25 hectare field which is to be tile drained has a drainage coefficient of 20 mm in 24 hours. By reference to the design chart (Figure 1) select suitable pipe sizes and gradients to provide for effective drainage of effluent.

- (b) Briefly discuss the relationship between pipe diameter and gradient for the tile drainage. Examples should be drawn from the design chart.
- (c) What is the influence of the following factors on the spacing of subsurface tile drains?
- soil type
 - watertable depth
 - drawdown.

(10 marks)

5 It is proposed to design a tile drainage system with the following established characteristics:

- 1 required depth of drained soil "a" = 0.8 m
- 2 required drawdown "h" = 0.5 m
- 3 hydraulic conductivity "K" = 1.0 m/day
- 4 required drainage rate "q" = 0.006 m/day
- 5 depth to impermeable layer "D" = 3 m

- (a) Using the Houghoudt design chart (Figure 2) determine the required drain spacing "L".

(5 marks)

- (b) If subsequent exploration found the supposed impermeable layer to be permeable in neighbouring field exhibiting similar characteristics what influence would this have on drain spacing?

(5 marks)

6 If water is flowing 0.75 metres deep in the channel cross-section detailed in Figure 3, and the bed and banks of the channel are well vegetated with short grass about 150 mm long, approximately what discharge would the channel be carrying?

(10 marks)

7 If the head loss through 250 m of 150 mm diameter pipe discharging 10 litres per second is 1.5 m, what head loss would occur in 500 m of the same type of pipe which is of 100 mm diameter, discharging 5 litres/second.

(5 marks)

8 A pipeline supplying water to an irrigation system consists of two sections of pipe corrected together by a reducer (with negligible head loss through the reducer).

The first section comprises 600 m of 75 mm diameter solvent welded plastic pipe incorporating three bends and a T-junction.

The second section comprises 300 m of 75 mm diameter old galvanised iron pipe with two bends, a T-junction and two gate valves.

All T-sections are run off the mainline, bends are 90° short radius types, gate valves are usually fully open (refer Table 1 for head losses).

The flow through the pipeline is 360 litres per minute at a pressure of 750 kPa.

- (a) What velocity of water flow would occur in the two sections of pipe?
- (b) At what pressure could the irrigation system be operated?

(10 marks)

- 9 From an investigation into the discharge from a pumpset it is found that less water is being delivered than was proposed when the pump was selected for the system. What factors could account for this phenomena?

(5 marks)

- 10 For the irrigation of water with a TDS of 800 mg/L compare the advantages and disadvantages of sprinkler irrigation versus trickle irrigation for a vineyard application.

(10 marks)

- 11 For an application rate of 6 ML/ha what volume of water would need to be applied to maintain a 10% leaching fraction?

(5 marks)

- 12 An irrigator obtains a flow of 10 ML/day through an outlet. This is used to irrigate a border check irrigation system with bays 400 metres long and 60 metres wide to a depth of 75 mm. The application efficiency of the system is 70%.

- (a) What volume of water will be required to water a bay?
- (b) How long will the watering of a bay take?
- (c) What drainage capacity should be allowed for, assuming 20% run-off?

(10 marks)

- 13 (a) What factors must be considered in the selection of a pump for irrigation purposes?

(3 marks)

- (b) How are these factors related together in the selection process?

(3 marks)

- (c) If the selected pump cannot develop the required dynamic head, how would the hydraulic system be affected?

(2 marks)

- (d) If the selected pump develops a higher dynamic head than was anticipated, how would the hydraulic system be affected?

(2 marks)

14 What techniques are available for predicting plant water requirements through the utilization of either climatic information or soil moisture conditions?

(15 marks)

15 What are the advantages and disadvantages of surface and subsurface drainage systems.

(10 marks)