

AGRICULTURAL AND FOOD ENGINEERING DEPARTMENT, IIT KHARAGPUR

Date of Examination: 24.04.09 AN

Full Mark: 50

End Spring Semester 2008-09

No. of Students: 08

Subject No: AG 60012

Subject Name: Farm Drainage Systems Design

Attempt all questions

1. A sub-surface drainage system is laid along a length of 300 m with laterals spaced 25 m apart. The outflow through one lateral is measured to be $5.5 \text{ m}^3/\text{hour}$. What is the drainage coefficient? (5)
2. A flat area is drained by parallel open ditch drains spaced 25 m apart and 300 m long. If the drainage coefficient is 4 cm what will be the flow at the outlet end of each drain? Design the most economical trapezoidal section when the drains are to be laid along a gradient of 1.5% and side slopes are to be kept as 1:1. Consider Manning's n as 0.04. (8)
3. How many hectares of waterlogging will a 25 cm diameter subsurface drain laid at a slope of 0.3% can control if the pipes are placed in an area where drainage coefficient can be taken as 2 cm? (4)
4. Show schematic presentation of flow components of a groundwater sub-system underlain by semi-confined aquifer in an irrigated agriculture with surface drain. (4)
5. Water is applied in an irrigated area every 10 days. The field application losses, which percolate to the groundwater are 25 mm in each irrigation. The soil effective porosity is 0.05. The maximum permissible height of the water table is set at 1m below the soil surface. The drain level is chosen at 1.8 m below the soil surface. Calculate drain spacing if the depth of an impervious layer is found at 9.5 m below the soil surface, $K = 1\text{m}/\text{day}$, and the radius of the pipe drain is 10 cm. (8)
6. Sodium chloride salt of 8 gm has been dissolved in 2 litres of water. Express the salt concentration in ppm, in mhos/cm, millimhos/cm, micromhos/cm, dS/m, and meq/litre. (3)
7. Design an open ditch to drain 550 ha of land having a drainage coefficient of 2.5 cm. The soil is silt loam with recommended side slope is 1.5:1. The soil is silt loam and maximum permissible slope of the channel bed is 0.1 per cent. (8)
8. In a subsurface drainage system, the laterals were laid out 50 m apart and the 200 m long and have a grade of 0.3%. What is the diameter of the pipe to be used, if the drainage coefficient of the area is 2 cm and Manning's coefficient is 0.0108? If the drainage coefficient is increased to 3 cm, what will be the spacing of the laterals? (8)
9. Graphically show the relationship between relative crop yield (%) and EC_e , and write the equation between them. (2)

