

**AGRICULTURAL AND FOOD ENGINEERING DEPARTMENT
INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR**

Date of Examination 24/2/2011 (AN)
Midterm Spring Semester 2010-11

Marks: 30 Time: 2 hours
Course: M. Tech. (Land & Water Resources Engg.)
M. Tech. (Water Resources)
Subject Name: On Farm Water Management

Subject No: AG60104
No. of Students: 24

Question 1

- a. What surge irrigation and why is it more efficient than continuous irrigation?
- b. What are the different phases of surface irrigation? How basin irrigation is different than border irrigation?
- c. Name different methods of soil water measurements and describe any one of them briefly?
- d. What is deficit irrigation and how it may help in increasing water productivity?
- e. Why infiltration rate decreases with elapsed time?

(5)

Question 2

- a. A watercourse has a culturable command area of 100 ha. The intensity of irrigation during kharif and rabi seasons is 60 and 50%, and duty at its head is 60 and 50 ha/cumec, respectively. Determine the discharge required at the head of watercourse?
- b. Develop a relationship between volume wetness, mass wetness, bulk density and water density?
- c. Soil moisture measurements of 1 m deep profile taken using Neutron probe at an interval of 25 cm were 15.2, 18.5, 20.2 and 30.5% prior to irrigation and 33.1, 32.2, 33.0 and 32.5%, after an irrigation event, respectively. The moisture content of the profile at field capacity and permanent wilting point is 32% and 12% respectively. The crop has effective rootzone depth of 100 cm and required to be irrigated at 50% of MAD. Determine the following:
 1. Equivalent water depth in profile prior to irrigation and after irrigation
 2. TAW and RAW for the crop
 3. Irrigation requirement, deep percolation ratio, application efficiency and water requirement efficiency?
- d. What is production function and discuss its utility in irrigation management?

(2+2+4+2)

Question 3

- a. Determine the friction head loss through sprinkler laterals using the Hazen-Williams equation. The total length of lateral pipe ($L_1 + L_2$) = 200 m, in which $L_1 = 120$ m with dia 100 mm and $L_2 = 80$ m with dia 75 mm. The discharge from respective pipes $Q_1 = 10.1$ l/s and $Q_2 = 5.05$ l/s. Sixteen sprinklers are used, eight on each section with an average discharge of 0.63 l/s. Consider C for PVC pipe = 150, and Friction factor for 16 outlets = 0.363. (6)
- b. Determine the required capacity of sprinkler irrigation system to apply water at the rate of 1 cm/h. Two 95 m long sprinkler line are required. Ten sprinklers are spaced at 10 m intervals on each line. The spacing between lines is 18 m. (4)

Question 4

An infiltration study was conducted on surface irrigated field yielding the following cumulative intake function:

$$Z = 0.00812 t^{0.222} + 0.0002 t$$

In which Z has units of m^3/m^2 and t has units of minutes. Later, during the irrigation of this field, it was observed that the flow advanced to the end of the field in 90 min and then ran off for a time before the inflow was shutoff. Following cutoff, it took 10 more minutes for the water to recede from the field. If the irrigator wished to apply 5 cm to the lower end of the field, when should he have shut off the inflow? Also determine irrigation depth at upstream end of the field? (5)