AGRICULTURAL ENGINEERING 40089

Time : 3 hours *Full Marks* : 200

Instructions :

(1) The figures in the right-hand margin indicate full marks for the questions.

(2) There are two Sections (Viz. Section—A and Section—B). Seven questions are in each Section.

(3) Attempt any five questions from each Section.

(4) Use Separate Answer booklets for Section—A and Section—B.

SECTION—A

1. *(a)* Discuss the dominant mechanisms of soil erosion in high rainfall areas like the North-East India, and in dry areas like the deserts in Rajasthan. 10

(b) With the help of labelled diagram, discuss the working principle of a Parshall flume. 10

2. *(a)* Explain the hydrologic cycle. What is meant by hydrograph? 3+3

(b) Estimate the excess runoff to be disposed of through the outlet of a contour bund using the following data : 14

- land slope : 2%
- top width of bund : 0·5 m
- height : 0·6 m
- height of crest above ground level : 0·3 m
- slope of bund : 1·5 : 1
- VI : 0·85 m
- length of bund : 250 m
- intensity of rainfall for a 10-year recurrence interval and for the time of concentration : 80 mm/h

SEAL

- constant infiltration rate during the peak rainfall : 25 mm/h
- storage behind the bund before the peak rainfall : nil

3. *(a)* Describe in brief various methods of irrigation. 5

(b) A sprinkler irrigation system is designed to deliver a design daily irrigation requirement of 7 mm and a desired depth of 15 mm. Ten numbers of 250 m long laterals, with sprinklers in a 12·5 m square-spacing pattern are operated simultaneously to irrigate 25 ha field.

Determine—

(i) maximum time between successive irrigations;

(ii) the sprinkler system capacity required for a set length of 8 hours.

Assume that 1 hour is required to move each lateral in a set and application efficiency is 80%. 15

4. *(a)* Describe in brief various methods of drainage. 5

(b) Estimate the discharge capacity of a parabolic grassed waterway using following data :

- top width of flow : 7·5 m
- depth of flow : 0·3 m
- bed slope : 3%
- roughness coefficient of grass : 0·04 m

Also estimate the percentage change in the discharge capacity of the channel section if with the passage of time, the roughness coefficient of grass is changed to 0·045. 8+7

5. *(a)* Explain the following terms : 6

(i) Infiltration

(ii) Runoff

(b) Soil under consideration has a water table condition i.e., equilibrium water table depth 600 mm below ground level. One 125 mm diameter outer hole is drilled to a depth of 1 m below the ground level. An impermeable bed is located at a depth of 25 m below the ground level. Determine the hydraulic conductivity of the above soil if the water table rises from 120 mm to 200 mm in 22·5 seconds. Also calculate the time required for the water level to rise from 1·0 m to 1·25 m level assuming constant hydraulic conductivity as 1. 7+7

6. (a) Explain the terms *(i)* hydraulic gradient and *(ii)* hydraulic conductivity. 3+3

(b) Calculate the diameter of a tile drain system, if the peak discharge, which has to be drained through the tile drain when it just flows full, is given by

$$Q = 6 \cdot 0 \times 10^{-4} S^{0 \cdot 5} n^{-1}$$

where

Q = discharge, m^3/s

S = drain bed slope (fraction)

n = Manning's roughness coefficient

Assume appropriate data where required. 14

7. (a) Explain important factors to be considered for selecting construction materials of farm buildings. 6

(b) Discuss the disadvantages of using steel as materials for construction of farm structures. 6

(c) In a concrete mixture of 1 : 3 : 5, twenty-four m^3 of sand were recommended to be used in putting up of a foundation of a building. Estimate the volumes of the other two components of the mix. 8

SECTION—B

8. (a) With the help of labelled sketch, describe the working of the fuel supply system of a modern farm tractor. 8

(b) State the differences between dry and wet type air cleaner used in tractor. 4

(c) How is a spark ignition different from compression ignition? Also discuss the following properties of diesel fuel : 4+4

(i) Kinematic viscosity

(ii) Cetane rating