

## AGRICULTURE ENGINEERING

### Paper - I

Time Allowed : Three Hours

Maximum Marks : 200

#### Question Paper Specific Instructions

*Please read each of the following instructions carefully before attempting questions :*

*There are EIGHT questions in all, out of which FIVE are to be attempted.*

*Questions no. 1 and 5 are compulsory. Out of the remaining SIX questions, THREE are to be attempted selecting at least ONE question from each of the two Sections A and B.*

*Attempts of questions shall be counted in chronological order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.*

*All questions carry equal marks. The number of marks carried by a question/part is indicated against it.*

*Answers must be written in ENGLISH only.*

*Unless otherwise mentioned, symbols and notations have their usual standard meanings.*

*Assume suitable data, if necessary and indicate the same clearly.*

*Neat sketches may be drawn, wherever required.*

#### SECTION A

**Q1. Answer each of the following in about 150 words each : 8×5=40**

- (a) Discuss the runoff cycle with a neat sketch. 8
- (b) What is the weakness of rational formula in estimating peak runoff rate ? What is the time of concentration of the watershed having length of 1500 m and land slope 0.5% ? 8
- (c) The annual maximum one day rainfall (mm) for 10 years is as follows :  
85, 91, 178, 80, 130, 105, 215, 90, 200 and 165.  
Find the approximate values of 5-year 1-day and 2-year 1-day rainfall. 8

(d) The longest lengths of a watershed consist of 60, 75, 80 and 75 m of slopes 0.1, 0.15, 0.20 and 0.25% respectively. Determine the average slope and time of concentration of the watershed. 8

(e) The following elevations of contour lines and the areas within the contour lines were found in a pond :

<u>Elevation of contour lines (m)</u>	<u>Area within the contour lines (ha)</u>
33	0.08
35	0.35
37	0.45
39	0.70
41	0.95

Calculate the storage capacity of the pond. 8

- Q2.** (a) Define weathering. Discuss the mechanics of water erosion. 10
- (b) Discuss the topographic effect of soil erosion. 10
- (c) Discuss the factors that affect the shape of a hydrograph. 10
- (d) Discuss the symptoms of water erosion in soil. 10

**Q3.** (a) Design a contour bund with the following : 20

Land slope = 2.0%

Rainfall abstraction = 30%

The maximum rainfall expected in 10-year recurrence interval = 10 cm

Horizontal spacing between the bund = 100 m

Side slope of the bund = 1.5 : 1

Seepage line of bund soil = 5 : 1

Freeboard = 20% of water depth

- (b) Describe the stages of gully development. 10
- (c) Discuss the effect of tillage practices on soil erosion. 10

- Q4.** (a) Determine the volume of earth work from the following : 10
- Bottom length = 20 m  
Bottom width = 12 m  
Side slope = 2 : 1  
Depth = 3 m
- (b) Define terrace. Describe the procedure for design of a bench terrace. What is the horizontal distance of broad base terrace of land slope 5% ? 10
- (c) What are the benefits of organic mulch ? Discuss the minimum tillage with its objectives. 10
- (d) Differentiate active and passive remote sensing. What are the stages of remote sensing ? 10

## SECTION B

**Q5. Answer each of the following in about 150 words each : 8×5=40**

- (a) Define open channel. With the diagram discuss the different components of it. 8
- (b) Water is applied at a rate of 30 l/s in a border strip 6 m wide. The estimated depth of water flow is 7.0 cm and the rate of infiltration is 3.5 cm/h. Determine (i) the time required for the water to reach a distance of 350 m, (ii) the average depth of water applied, and (iii) the maximum area and length of border that can be irrigated. 8
- (c) What is a pump ? Classify the types of pumps.  
A pump lifts 93,600 litres of water per hour against a total head of 21 m. Compute the water horse power. If the pump has an efficiency of 7.2%, what size of prime mover is required to operate the pump ? 8
- (d) What is a Cipolletti weir ? What are the advantages of it over other weirs ? Compute the discharge of a rectangular weir of 50 cm width and 15 cm head of water for no-end contraction, one-end contraction and two-end contraction. Use Francis' formula. 8
- (e) What do you mean by irrigation efficiency ? Determine the water use efficiency from the following data : 8

No. of treatment	Depth of water applied, cm	Effective rainfall, cm	Soil water used, cm	Seed yield, kg/ha
1	4	3.5	2.5	1225
2	6	3.5	2.3	1320
3	8	3.5	2.1	1440
4	10	3.5	1.9	1450

- Q6. (a)** Differentiate net and gross irrigation requirement and irrigation interval and irrigation period. Calculate the cumulative evaporation required for scheduling irrigation at IW/CPE ratio of 0.5, 0.6 and 0.8 with 5 cm of irrigation water. 10
- (b) Determine the discharge of a channel of bed width = 2.0 m, depth of water = 1.5 m, side slope 1.5 : 1 and longitudinal slope = 1 in 1000. Assume Manning's  $n = 0.04$  and any reasonable data, if necessary. 20
- (c) A trapezoidal channel of length 30 m, bottom width 20 cm, side slope 0.5 : 1 is laid on a land of 0.2% slope. At some point of time the depth of water at upstream end is 20 cm. What is the volume of water in the channel ? 10

- Q7.** (a) What is sub-surface drainage ? What are the factors that cause increase in the ground water level ? What are the advantages of sub-surface drainage over surface drainage ? 10
- (b) A 30 cm diameter well completely penetrates a confined aquifer of permeability 50 m/day. The length of the strainer is 25 m. Under steady state of pumping the drawdown at the well was found to be 3.5 m and the radius of influence was 300 m. Calculate the discharge. 10
- (c) Define drip irrigation. Give some other names of drip irrigation. What are the advantages and disadvantages of drip irrigation ? 10
- (d) A sprinkler irrigation system is designed to deliver a daily irrigation requirement of 7 mm and a desired depth of 15 mm. Ten 300 m long laterals with sprinklers in a 15 m square spacing pattern are operated simultaneously to irrigate a 25 ha field. Determine the maximum time between successive irrigations and the sprinkler system capacity required for a set length of 8 hours. Assume that 1 hour in each set is required to move each lateral and an application efficiency of 80%. 10
- Q8.** (a) What is the farm silos ? Classify and discuss. 10
- (b) Why is salt in soil a problem ? What are the causes of salt problem in soil ? 10
- (c) Determine the most efficient cross-section in an open channel to carry a discharge of  $1.5 \text{ m}^3/\text{s}$  for trapezoidal channel. Assume the channel bed slope of 0.005 and  $n = 0.02$ . The side slope is 1.5 : 1. 10
- (d) What do you mean by irrigation efficiency ? What is the importance of it ? A stream of 150 l/s was diverted from a canal and 120 l/s was delivered to a wheat field of 1.75 ha. The irrigation continued for 7.5 hours. The effective root zone depth was 1.8 m. The runoff loss in the field was  $450 \text{ m}^3$ . The depth of water penetrated linearly from 1.8 m at the head end to 1.2 m at the tail end. The moisture holding capacity of the soil is 25 cm/m depth of soil. Irrigation was given at 50% depletion of available soil moisture. Determine the water conveyance efficiency and application efficiency. 10