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 :

Elevation of contour lines (m)	Area within the contour lines (ha)
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 m^3/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 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*