INDIAN FOREST SERVICE P (EXAM-2014)   C-HENT-N-ZFQDA

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 m³/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 m³. 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*