2007

AGRICULTURAL ENGINEERING - II (Optional) 100076

Standard : Degree **Total Marks : 200**

Nature : Conventional **Duration : 3 Hours**

Note :

(i) *Answers must be written in* ***English.***

(ii) *Question* ***No. 1*** *is* ***Compulsory.*** *Of the remaining questions, attempt* ***any four*** *selecting one question from* ***each section.***

(iii) *Figures to the* ***RIGHT*** *indicate marks of the respective question.*

(iv) *Use of log table, Non-Programmable calculator is permitted, but any other Table/Code/Reference books are not permitted.*

(v) *Make suitable assumptions, wherever be necessary and state the same.*

(vi) *Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*

(vii) *Credit will be given for orderly, concise and effective writing.*

(viii) *Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.*

(ix) *For each slab of 10 and 15 marks, the examinee is expected to write answers in 125 and 200 words respectively.*

1. Answer ***any four*** of the following questions :

(a) A border irrigation system is to be designed to irrigate 20 hectares of wheat on a deep silt loam soil. The available moisture content of the soil is 10.66 percent and apparent specific gravity of the soil is 1.50 gm/cm^3. The depth of root zone is 1.0 meter. Irrigation water is applied at 50 percent depletion of available water in the root zone. The water application efficiency, water conveyance efficiency and peak rate of moisture use per day are 70%, 100% and 4.0 mm, respectively. Determine the irrigation period, the net depth of water per application, the depth of water pumped per application, and the required capacity of the irrigation pumping system in hectares per day. Lined channels distribute water to the fields. If the pumps work for 12 hours each day, what is the discharge capacity of the system in liters per second ? **10**

Marks

(b) Write different categories of water measuring devices used on the farm. Write necessary precautions in the use of weirs to get reliable results in measurement. What are the advantages of Parshall flume over weirs ? **10**

(c) India's rainfall is the highest for a country of comparable size anywhere in the world. Still the problems of water resource shortage persist. Why ? **10**

(d) Why does water resources planning need to be taken up on watershed basis ? What is the importance of watershed management ? State the objectives and components of watershed management. **10**

(e) Discuss different types of well screen used in India with sketch. **10**

SECTION - A

2. Answer the following sub-questions :

(a) Write about different types of soil moisture constants. Draw moisture characteristic curve for sandy loam and silt loam soil showing all the moisture constants. **10**

(b) (i) Determine the system capacity for a sprinkler irrigation system to irrigate 16 hectares of wheat crop. Design moisture use rate is 5 mm per day. Gross depth of irrigation is 7 cm. Irrigation period is 10 days in a 12 days interval. The system is to be operated for 20 hours per day. **5**

(ii) If the pressures at the opposite ends = of a sprinkler laterals are 3 kg/cm^2 and 2.6 kg/cm^2, what would be the discharge of the farthest sprinkler, provided the sprinkler at 3 kg/cm^2 end discharges 0.76 liters per second. **5**

(c) Derive an expression for hydraulic conductivity measurement in homogeneous soil by Single Auger hole method with assumptions. **10**

(d) Define drainage and drainage coefficient. Write about different types of surface drainage methods for flat land. **10**

Marks

3. Answer the following sub-questions :

(a) What is the difference between infiltration rate and basic infiltration rate ? Discuss different factors affecting the infiltration rate. Write the procedure of measuring infiltration with a concentric cylinder infiltrometer with sketch. **10**

(b) A stream of 150 liters per second was diverted from a canal and 100 liters per second were delivered to the field. An area of 1.6 hectares was irrigated in 8 hours. The root zone depth was 1.8 meter. The average runoff averaged 40 liters per second for 3 hours. The depth of water table penetration varied linearly from 1.8 meter at the head of the field to 1.2 meter at the end of the field. Determine the water conveyance efficiency, water application efficiency, water storage efficiency and the water distribution efficiency. Available moisture holding capacity of the soil is 20 cm/meter. **10**

(c) Discuss different types of drainage design criteria in detail. **10**

(d) Design a drainage canal to drain 550 hectares of land having a drainage coefficient of 2.5 meter. The soil is silt loam. Maximum permissible slope of channel bed is 0.1 percent. **10**

SECTION - B

4. Answer the following sub-questions :

(a) Derive an expression for estimating the transmissibility of confined aquifer in steady state condition convert in form of drawdown. **15**

(b) Find the channel section and discharge Q that can be allowed to flow in it, if B/D=5.7, bed slope=1/5000 and N=0.0225, use Kennedy's theory. Assume critical velocity ratio equal to one. **15**

(c) (i) What do you understand by a fall in a canal ? Why it is necessary and how do you select its location ? **5**

(ii) What do you understand by canal head regulator ? State the function of a distributary head regulator. **5**

Marks

5. Answer the following sub-questions :

(a) What is aquifer ? Write about different types of aquifers in details with neat sketch. **15**

(b) Design an irrigation channel in alluvial soil according to Lacey's silt theory. The following data are given below : **15**

Full supply discharge = 15 m^3/sec

Lacey's silt factor = 1.0

Channels side slopes = ½ : 1

(c) Discuss various types of cross drainage works with the help of neat sketch. **10**

SECTION - C

6. Answer the following sub-questions :

(a) (i) The following consecutive readings were taken with a dumpy level and a 4 m levelling staff on a continuously sloping ground at 30 m intervals : **5**

0.680, 1.455, 1.855, 2.330, 2.885, 3.380, 1.055, 1.860, 2.265, 3.540, 0.835, 0.945, 1.530 and 2.250.

The R.L. of the starting point was 80.750 m.

(1) Rule out a page of level book and enter the above readings.

(2) Carry out reduction of heights by collimation method.

(3) Apply the arithmetic checks including the checks on I.S.

(4) Determine the gradient of the line joining the first and last points.

(ii) Derive Laplace equation for 2-dimensional steady flow through isotropic and homogeneous soil mass. **10**

(b) How do the size, shape and slope of basin and rainfall intensity affect the shape of hydrograph ? **10**

(c) State the Universal Soil Loss Equation (USLE). What are its applications and limitations ? Why is crop management factor C more dominant than other factors in soil and water conservation programmes ? **15**

Marks

7. Answer the following sub-questions :

(a) (i) A river is flowing from west to east. For determining the width of the river two points A and B are selected on southern bank such that the distance AB=75 m. Point A is westwards. The bearings of a tree C on the northern bank are observed to be 38° and 338° respectively from A and B. Calculate the width of the river. **5**

(ii) Differentiate between compaction and consolidation of soils. Explain about quick sand conditions briefly. **10**

(b) In estimating the peak discharge of a stream at X, the catchment area was divided into four parts A, B, C and D. The time of concentration and the area for different parts are as follows : **10**

Part	Time of Concentration	Area, ha
A	1 h	600
B	2 h	750
C	3 h	1000
D	4 h	1200

Records for a rainstorm lasting for 4 h as observed, and the runoff factor during different hours are as follows :

Time in h from - to	Rainfall, mm	Runoff factor
0-1	25.0	0.50
1-2	50.0	0.70
2-3	50.0	0.80
3-4	23.5	0.85

Calculate the maximum flow to be expected at X in cumec assuming a constant base flow of 42.5 cumec.

(c) Why biological measures need to be given preference over mechanical (engineering) measures in soil and water conservation ? Compare their roles in soil and water conservation. **15**

Marks

SECTION - D

8. Answer the following sub-questions :

(a) Design the notch dimensions of a waste weir to discharge excess runoff from a contour bunded area on a land having an average slope of 3%. The horizontal spacing of the bund is 60 m and the bund is 400 m long. The specifications of the bund are : top width 60 cm, height 60 cm and side slopes 1.5:1. The crest level of the weir is 30 cm above ground level. Assume that the most severe rain occurring during the recurrence interval lasts for 3 hours. The rainfall intensities are such that 15 cm of rain occurs during the first hour, 18 cm during the second hour and 16 cm during the third hour. Infiltration and interception amount to 6 cm of water during the first 30 minutes and 5 cm during the next 30 minutes. The infiltration then becomes constant at 8cm/h. Calculate : **10**

(i) the storage capacity of the bund when the water surface is at the crest level of the weir, and (ii) the time required to fill the bund upto the crest level of the waste weir.

(b) Describe briefly the design steps in farm ponds. **10**

(c) Why is people's participation important in watershed management ? Outline the strategies for their viable participation. **10**

(d) Explain the attributes and applications of remote sensing and GIS in land and water management in watershed in brief. **10**

9. Answer the following sub-questions :

(a) Design a bench terrace for an area which has sandy loam soil and land slope as 15%. The terrace width acts as channel which is provided with a uniform grade of 0.4%. The other details are as under : **10**

(i) Maximum rainfall intensity of the area during 10-year return period is 25cm/h for the duration equal to the time of concentration.

(ii) Total length of bench terrace to be constructed is 150 m. Make suitable assumptions where necessary.

Marks

(b) Explain the necessity of rainwater harvesting in Indian agriculture. Discuss briefly the principles of rainwater harvesting. **10**

(c) What is the middle-third rule and where is it applied ? How are the failures by sliding and piping in gravity dam overcome ? **10**

(d) Discuss the computer applications in the discipline of Soil and Water Engineering and future trends. **10**

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