Time : 3 hours

Full Marks : 200

The figures in the right-hand margin indicate marks.

Canidates should attempt Q. No. 1 from

Section – A and Q.No. 5 from Section – B

*which are compulsory and any **three** of*

the remaining questions, selecting

*at least **one** from each Section.*

SECTION – A

1. Answer any **two** sub-parts not exceeding **150** words for each sub-parts : $20 \times 2 = 40$

   (a) Describe the process of movement of soil particle during erosion of soil by wind. Is there any similarity with the movement of soil particles caused by water in a channel ? If so, bring out the base points of similarity between these two processes.

(b) What is a hydraulic jump ? Explain different practical applications of the phenomenon of hydraulic jump.

(c) Describe, with the help of neat sketch, any three methods of separation of base flow from the hydrograph of runoff indicating the situations under which the methods are suitable.

2. (a) Name various types of bench terraces and describe the conditions under which these are preferred. What are the factors which affects the design of bench terraces ?   10

(b) What is watershed and why it is considered as a basic unit for agricultural development ? What are the important steps to be considered for watershed planning ?   10

(c) Define Runoff and explain the rational method of computing the peak discharge of small catchment.   10

(d) Define resolution, topology, geodesy, sensor, atmospheric window, swath width and image parallax.   10

3. (a) Classify soil conservation structures into various categories. Draw a neat diagram of a drop spillway. Label and describe functions of various parts of the drop spillway structure.

10

(b) Tabulated are the data derived from a drainage basin. Determine the average depth of rainfall using Thiessen polygon method :

10

Station	Rainfall (mm)	Area covered (km^2)
A	26.9	108
B	15.4	35
C	28.2	18
D	19.2	110
E	14.6	107
F	6.5	71
G	29.8	83
H	45.0	66
I	50.0	12
J	19.7	9

(c) What are the ill effects of water erosion ?
Describe, in brief, the various forms of water
erosion.   10

(d) Determine the design peak runoff rate for a
25 years recurrence interval from an area in
clay loam containing 20 ha of cultivated land
on 1% slope, 35 ha of pasture land on 7%
slope and 30 ha of woodland on 12% slope.
The most remote point in the watershed is
3200 m away from the outlet. The outlet is
8 m below this point. The maximum intensity
of 1 hour rainfall expected during the
recurrence interval is 7.5 cm.   10

4.   (a) A 3 hour storm occurred at a place and the
precipitations in the neighboring rain-gauge
stations P, Q and R were measured as 3.8,
4.1 and 4.5 cm, respectively. The
precipitation in the neighboring staion S
could not be measured since the rain gauge
bottle was broken. The normal precipitations
in the four stations P, Q, R and S as per IMD
Bulletin were 45, 48, 53 and 50 cm,
respectively. Estimate the storm precipitation
at station S.   10

(b) Draw a single peaked hydrograph and indicate its various components.   10

(c) Draw a neat graph of spectral reflectance curve for soil, water and vegetation using IRS bands and discuss them in short.   10

(d) What is GIS ? What are the five components of GIS ? Write utility of GIS in land and water resources management.   10

SECTION – B

5. Answer any **two** sub-parts not exceeding **150** words for each sub-parts :   20×2 = 40

(a) Derive the Hooghoudts equation for constant ground water table at uniform rate of irrigation or rainfall. Enlist the required assumptions for the derivation.

(b) Find the moisture content of a soil from the following data.

Root zone depth = 2 m, moisture constant in the soil at the time of commencement of study = 5%, dry density of soil = 1.5 g/cm^3, water applied to the soil = 50 m^3, water lost due to evaporation etc = 10% and area of plot = 1000 m^2.

(c) What do you mean by irrigation scheduling ? What are the different criteria for scheduling the irrigation for the field crops ?

6. (a) Determine the required capacity of a sprinkler system to supply water at the rate of 1.25 cm/hr. Two 186 m long sprinkler lines are installed. Sixteen sprinklers are spaced at 12 m intervals on each line. The spacing between lines is 18 m, allowing 1 hour for moving each 186 m sprinkler line. How many hours would be required to apply a 5 cm depth of irrigation to a square 16 ha field ? How many days are required to irrigate the area assuming that systems work for 10 hours daily ? 10

(b) List the various types of farm pond. Describe the embankment type of farm pond and write the formula used for calculation of top width of the pond. 10

(c) Write the name of different types of surface and sub-surface drainage method adopted in India. Differentiate between mole drain and bedding system. 10

(d) Work out the economical diameter and depth of a silo to store sufficient quantity of silage for a herd of 400 dairy cows having an average body weight of 450 kg each. The cows are fed silage for 200 days a year. 10

7. (a) What is meant by Duty and Delta of canal water ? Drive the relationship between duty and delta for a given base period. 10

(b) What is meant by saline and alkaline soils ? How to deal with the salinity and alkalinity problem of soil ? 10

(c) Write short notes on the following : 2×5 = 10

(i) Specific yield

(ii) Transmissibility

(iii) Storage coefficient

(iv) Reynolds number

(v) Hydraulic conductivity

(d) What is the soil moisture content ? Write the different techniques of soil moisture measurement in the field. 10

8. (a) A tube well having a capacity of 4000 lps operates 20 hours each day during the irrigation season. How much area can it command if the irrigation interval is 20 days and depth of irrigation is 7 cm? 10

(b) Define the terms "Evapotranspiration". Write the different methods of estimation of Evapotranspiration and explain the working principle of lysimeter. 10

(c) What is a Farmstead ? What factors govern the location of the farmstead on the farm ? 10

(d) Groundwater is fast depleting in most of the arid and semi arid regions of our country, what are the factors responsible for it and what solution you would like to offer to combat this situation as an engineer ? 10

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