Course No: CE F321   **Date: 15-03-2022 (Tuesday)**
Duration: 90 min (2:00 – 3:30 PM)   **Max. Marks: 60**

Instructions:
1. Show all calculations/steps in detail. No marks will be awarded for correct answers without proper calculations
2. Read question carefully and express the answers only in the units you are instructed to use
3. Use graph paper wherever necessary and sharing of calculators is not allowed

Q.1. Answer the following in the form of a short paragraph/points: **[2 x 5 = 10 M]**
   a. Please list the storage and transportation components of a hydrologic cycle.
   b. Differentiate between phi index and w index. Also mention respective equations.
   c. Why do we represent precipitation in 'depth' units instead of 'volumetric' units? Explain with the help of an example.
   d. What do you mean by 80% dependable yield or runoff volume?
   e. What is ADCP and how it works?

Q.2.
a. Hydrologists in the southern India examined an area of 1235.53 acres and found predominance of non-black cotton soil and CN_{II} has been established as 68. (a) If the total rainfall in the past five days is 25 cm and the season is dormant season, estimate the runoff volume due to 80 mm of rainfall in a day? (b) What would be the runoff volume if the rainfall in the past five days were 35 mm? *Please express both answers in **m^3** units only.*
                                                                                          [7 M]
b. Estimate CNI, CNII and CNIII for a catchment with following land use.   **[3 M]**

Land use	Soil group C (%)	Soil group D (%)	Total % area
Cultivated land (Paddy)	30	45	75
Scrub forest	6	4	10
Waste land	9	6	15

Q.3. There is an isolated 3-h storm which occurred over a basin in the following fashion: **[10 M]**

% of catchment area	Phi index (cm/h)	Rainfall (cm)		
		1st hour	2nd hour	3rd hour
20	1.00	0.8	2.3	1.5
30	0.75	0.7	2.1	1.0
50	0.50	1.0	2.5	0.8

Estimate the runoff from the catchment due to the storm. Express your answer in depth **(cm)** units only.

Q.4. Write Horton's equation for determining the infiltration and mention the meaning of each parameter in the equation. Mention the names of any two other equations used for determining infiltration. Table below shows the infiltration data obtained using double ring infiltrometer. Determine the best values of the parameters of Horton's infiltration capacity equation. *All answers concerning infiltration capacities should be expressed in **cm/h** only.* Ignore any observational errors while plotting the graph. Take fc = 1.5 cm/h   **[10 M]**

Time since start in minutes	5	10	15	25	40	60	75	90	110	130
Cum. Infiltration (mm)	21	36	47.6	56.9	63.8	69.8	74.8	79.3	87	92

Q5. Table below gives the data observed at a reservoir near Delhi. Estimate mean monthly (**mm/month**) and annual evaporation (**mm**) from the reservoir using Meyer's formula. Using Penman's equation, calculate the consumptive use (in **mm**) in the month of June. Take following data:

Elevation of the area = 230 m above MSL
Latitude = 28°N
Mean monthly temperature = 20°C
Mean observed sunshine = 9h/day   **[10 M]**

Month	Temp (°C)	Relative humidity (%)	Wind velocity at 2 m above GL (km/h)
Jan	12.5	85	4
Feb	15.8	82	5
Mar	20.7	71	5
Apr	27.0	48	5
May	31.0	41	7.8
Jun	33.5	52	10
Jul	30.6	78	8
Aug	29.0	86	5.5
Sep	28.2	82	5
Oct	28.8	75	4
Nov	18.9	77	3.6
Dec	13.7	73	4

Q.6. Irrigation department decided to grow two types of crops over an equal area. The total area available is 420 hectares (i.e., 210 hectares for each crop) for the period covering from 1st July 2015 to 31st of October 2015. Climatic data and the type of crop grown during the period is given below.   **[10 M]**

Month	Crop grown	Mean temperature (°C)	Rainfall (cm)
July	Rice	32.5	14.1
August	Rice	31.2	18.4
September	Maize	29.7	13.0
October	Maize	28.4	10.4

Assume effective rainfall at 80 % (cm). Using Blaney- Criddle method (formulae given in the question itself), calculate the net irrigation demand (**cm**) and the volume of water (**m³**) required for each crop.

For Blaney-Criddle method, use following equations: PET = $\sum$K.F, where F = $(0.0457T_m + 0.8128)$P

K is monthly crop coefficient (1.1 for rice and 0.65 for maize), F is monthly consumptive use factor
PET is potential evapotranspiration in cm
T_m is mean monthly temperature in ^{0} C, and
P is the monthly percentage of hours of bright sunshine in the year

Wish you all the best!