Mid-West University
Examinations Management Office
Semester End Examinations 2081

Bachelor level/ B.E. Civil/ 5th Semester

Time: 3 hours

Subject: Engineering Hydrology (CE456/CE319)

Full Marks: 50

Pass Marks: 25

- *Attempt all the questions*
- *Figures in the margin indicate full marks.*
- *Assume suitable values, with a stipulation, if necessary.*
- *Candidates are required to answer the questions in their own words as far as possible.*

1. What is hydrological cycle? Why do we need to study hydrological cycle and under budget equation? **[3]**

2. A 4-hour storm occurs over an 80 km² watershed. The details of the catchment are as following. **[8]**

Sub basin (km²)	Ø Index (mm/h)	Hourly Rainfall (mm)			
		1st hour	2nd hour	3rd hour	4th hour
15	10	16	48	22	10
25	15	16	42	20	8
35	21	12	40	18	6
5	16	15	42	18	8

Calculate the runoff from the catchment and the hourly distribution of the effective rainfall for the whole catchment.

3. Find the mean precipitation for the area shown in the figure by the Thiessen polygon method. The area is composed of a square plus an equilateral triangular plot of side 2 km. Rainfall readings are in cm at the various stations indicated. **[6]**
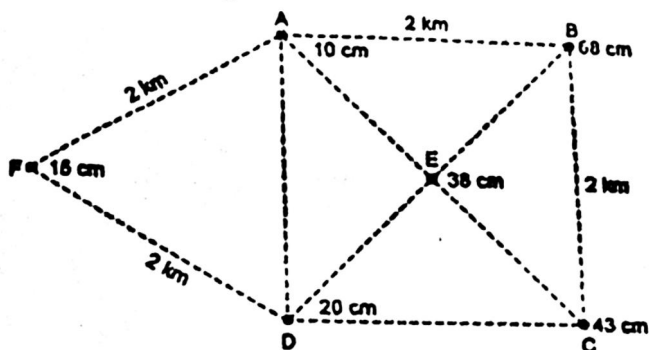
4. Followings are the data obtained from a stream gauging station. A current meter with a calibration equation $V = (0.32N + 0.032)$ m/s where N = revolutions per second, was used to measure the velocity at 0.6 depth. Calculate the discharge in the stream. **[5]**

Distance from right bank (m)	0	2	4	6	8	11	14	17	19	21	22	24
Depth (m)	0	0.5	1.1	1.95	2.25	1.85	1.75	1.65	1.50	1.25	0.75	0
No. of Revolutions	0	80	83	131	139	121	114	109	92	85	70	0
Time (Sec.)	0	180	125	125	125	130	130	130	130	140	145	0

5. What is a rating curve in hydrology, and how is it used in estimating river discharge? **[3]**

6. Define unit hydrograph and flood hydrograph. What are the uses and limitation of unit hydrograph? [4]

7. The following are the ordinates of the total runoff hydrograph of flow from a catchment area of 1050 km² due to a 6-hour rainfall. [4+4]

t (hr)	0	6	12	18	24	36	42	48	54	60	66
Q (m³/s)	30	45	125	220	340	250	144	110	60	40	30

   i. Derive the ordinate of 6-hour unit hydrograph. (assume suitable base flow)
   ii. Using the derived 6-hour unit hydrograph calculate the flood hydrograph for 2 successive storms of 9.5 cm and 12.5 cm of 6 hours' duration each and Ø-index of 0.25 cm/hr.

8. i. Find out the frequency of a flood of magnitude 2539 m³/s, given the following record of maximum yearly peak floods for 10 years [4+3]

Year	1	2	3	4	5	6	7	8	9
Q (m³/s)	300	700	200	400	1000	900	800	500	100

   Take the value of reduced mean and reduced standard deviation in Gumbel's Extreme value distribution as 0.4952 and 0.9496 respectively.
   ii. What is the probability of exceedance of flood of magnitude 2539 m³/s? what is the probability that this flood may occur in the next 100 years?

9. Groundwater is a vital resource in Nepal, especially in main cities and regions like Terai, where it supports agriculture, domestic, industrial, and commercial use due to its growing population and limited surface water availability. However, increasing demand, over-extraction, and inadequate recharge measures have led to declining groundwater levels, drying wells, and water scarcity in several areas. Analyze the impact of increasing groundwater demand and over-extraction in Nepal. What are the major challenges faced due to groundwater depletion, and what sustainable measures can be implemented to ensure long-term groundwater availability? [6]

The End