



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2018

COURSE NO: ES 372
COURSE NAME: HYDROLOGY
CLASS: ES III **TIME:** 3 HOURS

Name: _____ Index Number: _____

Answer questions one (1) and two (2) and two other questions. Marks will be awarded for good presentation

1.

a. Briefly explain the following terms as applied in hydrology

- | | |
|-----------------------|-------------------|
| i. Water balance | ii. Catchment |
| iii. Groundwater | iv. Vadose zone |
| v. Capillary fringe | vi. Aquifer |
| vii. Ephemeral stream | viii. Baseflow |
| ix. Return period | x. Surface runoff |

(2 marks each)

b. The initial infiltration capacity f_o of a catchment is estimated as 4.5 mm/hr, the time constant as 0.35/hr and the capacity as 0.4 mm/hr. Use the Horton's equation to find

- the value f_t at $t = 30$ min, 2 hr, and 3 hr.
- the volume of infiltration over the 6-hr period. Assume continuously ponded conditions.

(5 marks)

2. a. Calculate the average annual rainfall amounts for stations A, B, C and D.

Year	A	B	C	D	X
1990	6.6	8.9	8.7	9.8	8.8
1991	5.5	5.7	5.6	5.0	5.6
1992	9.6	9.7	9.7	9.0	10.0
1993	14.9	16.9	16.6	16.7	16.7
1994	22.8	18.0	23.9	21.6	20.5
1995	21.4	22.7	21.7	23.0	23.4
1996	18.1	17.1	16.7	15.6	17.9
1997	18.6	17.9	16.9	18.5	16.8
1998	16.7	18.1	17.1	17.1	16.4
1999	19.3	18.7	17.9	20.3	19.3

(2 marks)

b. By assuming that stations A, B, C and D are closely located, estimate the missing rainfall of station X for the months of April 2000.

2000	A	B	C	D	X
April	4.5	3.2	1.2	0.5	?

(3 marks)

- c. Consider the table below. Use the information provided to calculate for the average rainfall using arithmetic mean method, Thiessen polygon method and Isohyetal method. Comment on the results obtained using the three (3) methods

Rainfall (mm)	10	20	30	40	50	60	70	80
Area (km ²)	7	120	109	120	20	92	82	76

(5 marks)

3.

- a. As upcoming Environmental Hydrologist, highlight four (4) activities of man that affect the hydrologic cycle. (4 marks)
- b. With the aid of a diagram, describe the components of a hydrograph. (4 marks)
- c. What is a unit hydrograph (1 mark)
- d. Describe four (4) factors that affect the shape of a hydrograph (4 marks)
- e. As Environmental hydrologist, do you think it is necessary to survey flood? Why? (2 marks)

4.

- a. A drainage channel for storm water is lined with smooth concrete and has vertical sides with a flat bottom that is 3.50 m wide. The bottom drops 1.50 m over a distance of 500 m. If the channel contains 1.50 m of water, what is the discharge?
(for a smooth concrete, Manning's roughness coefficient is 0.012) (5 marks)
- b. Information is provided in the table below on River Bediabewu which has a width of 30 m. Use the information provided to determine the total discharge.

Depth (m)	0.25	1.75	3.00	4.50	6.25	5.75	2.50
V(0.2) m/s	0.25	1.00	1.75	3.00	4.25	5.75	6.25
V(0.8) m/s	0.10	0.75	1.0	1.75	4.00	4.25	3.75

(10 marks)

5. Use the information provided in the table below to find the inconsistent data at rainfall station 1. Only one (1) graph is required.

Year	Annual rainfall (mm)									
	A	B	C	D	E					
1981	22.46	24.7	32.79	30.82	31.66					
1982	26.81	33.6	32.35	38.61	33.61					
1983	23.66	31.94	25.99	27.71	33.11					
1984	19	29.06	29.38	36.1	25.24					
1985	46.71	29.29	49.88	42.62	44.43					
1986	36.99	30.89	38.28	32.06	38.49					
1987	24.27	21.51	26.19	23.66	31.88					
1988	37.42	25.95	28.9	33.34	36.32					

(15 marks)

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