(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATION
2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS
FOR THE DEGREE OF
BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 354

COURSE TITLE: HYDROLOGY

DATE: FRIDAY 29TH APRIL 2022 — **TIME: 3.00 – 5.00 PM**

INSTRUCTIONS:
1. This paper contains FOUR questions
2. Answer question ONE (compulsory) and any other TWO question
3. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

CSE 354 HYDROLOGY

QUESTION 1 [30 Marks]

(a) Briefly explain the importance of studying Hydrological Frequency analysis   [6 Marks]

(b) Differentiate between the following as used in hydrological frequency studies:

    i. Plotting position and Return Period   [4 marks]

    ii. Safety factor and Reliability   [4 marks]

(c) The mean of the annual maximum discharge for a 25-year data (1996-2020) of a river is $47.92cm^3/s$. The Standard deviation is $9.40cm^3/s$. Estimate the magnitude of the 60-year flood using Gumbel's equation.   [7 Marks]

(d) Use the Thornthwaite Equation to estimate the potential evapotranspiration (PET) for alfalfa crop grown at altitude 28^0 N. Assuming a reduction factor R_f of 1.2 and the growing season is from March to July   [9 Marks]

Rainfall	J	F	M	A	M	J	J	A	S	O	N	D
T_m ^{0}C	4	3	2.7	2.5	7	11	10	15	7	4	3	4.5

QUESTION 2 [20 Marks]

(a) Differentiate between the following

    (i)   Overland flow and Direct runoff   [4Marks]

    (ii)   Depression storage and Base flow   [4 Marks]

(b) Rainfall of magnitude 6.5 cm and 4.5 cm occurring on two consecutive 2-h duration on a Catchment of 30 km^2 provided the following hydrographs of flow at the outlet.

    (i) Plot the hydrograph   [3 Marks]

    (ii) Estimate the runoff depth   [7 Marks]

    (iii) Estimate the φ index of the storm   [2 Marks]

Time start of rainfall (h)	-2	0	2	4	6	8	10	12	14	16	18
Observed flow (m3/s)	7	6	7.5	12.5	20	26	20	11	8	6	5

QUESTION 3 [20Marks]

(a) Distinguish between the following as used in groundwater studies

    i. Confine and unconfined aquifer   [4 Marks]

    ii. Specific storage and Specific yield   [4 Marks]

(b) A confined aquifer has a total thickness of 20m with the original piezometric head being 65m. The aquifer is fully penetrated by a well of diameter 30cm and pumped at a rate of $2.5m^3$/min. Two observation wells at a distance of 130m and 150m from the pumping well has a hydraulic head of 59.5m and 60.0m respectively. Determine the coefficient transmissivity of the aquifer and the drawdown at the pumping well.   [12 Marks]

(c) An unconfined aquifer released 5 x $10^5 m^3$ of water for a water drop of 2m over a horizontal area of 1km^2. The aquifer porosity is 40% and has a hydraulic conductivity 0f 0.002cm/sec. Compute the specific yield marks and the specific retention   [3 Marks]

QUESTION 4 [20 Marks]

(a) Distinguish between Rating curve and Flow duration curve   [4 Marks]

(b) The data pertaining to stream-gauging operation at gauging site are given below. The rating Equation of the current meter is V = 0.6 N + 0.15 m/s. Calculate the discharge in the stream.

[16 Marks]

Distance from the left Water edge (m)	0	2	4	6	8	10	12	14	16
Depth (m)	0	1	2	3	4	3.5	2	1.5	0
Revolutions at 0.2 of depth	0	60	80	140	160	120	90	65	0
Revolutions at 0.8 of depth	0	40	60	100	130	90	60	40	0
Duration of Observation (s)	0	140	145	146	145	140	145	144	0

You may find the following equation useful

$$a = 0.4923 + 0.01792T_e - 0.0000771T_e^2 + 0.000000675T_e^2$$