



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV: 307: HYDROLOGY 1

DATE:

TIME:

INSTRUCTIONS

- This paper comprises of FIVE questions. Answer **THREE** questions
- Question one is **compulsory** and carry 30 marks
- Answer any other **TWO** questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- Define the term hydrology. (2 marks)
- Discuss the importance of studying hydrology in civil engineering. (4 marks)
- Discuss advantages of recording rain gauges over non recording gauges. (3 marks)
- Define the term run-off and discuss the factors that affect the rate of run-off on a watershed (5 marks)
- Students from Machakos University were carrying out hydrological studies within the university which has the following characteristics, an area of 26560km^2 , perimeter 965km and a longitudinal length of 230 km. Determine:
 - Form factor of the basin. (2 marks)
 - Compactness coefficient. (2 marks)
 - Elongation ratio. (2 marks)
 - Circularity ratio. (2 marks)
- Explain the conditions and mechanics of rainfall formation. (4 marks)
- Outline four methods that are used for ground water exploration. (4 marks)

QUESTION TWO (20 MARKS)

- a) Discuss the effects of the global climate change on hydrological cycle. (6 marks)
- b) Rainfall depth over Mua Hills watershed is monitored through six well distributed rain gauges whose gauged data are given below. Calculate the thiessen mean value of the rainfall. (4 marks)

Rain Gauge Number	1	2	3	4	5	6
Rainfall Depth (mm)	470	465	435	525	480	510
Area of Thiessen Polygon ($\times 10^4 \text{ m}^2$)	95	100	98	80	85	92

- c) Outline the factors that you would consider in selecting a site for a stream gauging station. (6 marks)
- d) A small water shed in kilifi County consists of 2 km^2 of forest area ($c = 0.1$), 1.2 km^2 of cultivated area ($c = 0.2$) and 1 km^2 under grass cover ($c = 0.35$). A water course falls by 20 m in a length of 2 km. The IDF relation for the area may be taken as $i = 80T^{0.2}/(t+12)^{0.5}$. Estimate the peak rate of runoff for a 25 yr frequency. (4 marks)

QUESTION THREE (20 MARKS)

- a) What is the difference between watershed and a catchment area. (2 marks)
- b) Differentiate between aquiclude and aquitard. (2 marks)
- c) The volume of atmospheric water is 12900 km^3 . The evapotranspiration from land is $72000 \text{ km}^3/\text{year}$ and that from ocean is $505000 \text{ km}^3/\text{year}$. Estimate the residence time of water molecules in the atmosphere (in days). (2 marks)
- d) With an aid if a well labelled diagram, show the different parts of a non-recording Symons rain gauge and explain how it works. (4 marks)
- e) The following are the rain gauge observations during a storm. Construct:
- (a) mass curve of precipitation (4 marks)
 - (b) hyetograph. (4 marks)

Time since commencement of storm (min)	Accumulated rainfall (cm)
5	0.1
10	0.2
15	0.8
20	1.5
25	1.8
30	2.0
35	2.5
40	2.7
45	2.9
50	3.1

QUESTION FOUR (20 MARKS)

- Discuss the factors that affect evapotranspiration. (4 marks)
- Determine for the month of February the mean ETo in mm/day using the Blaney-Criddle method at a Latitude 10° south where the mean daily percentage (p) of annual daytime hours was 0.29 and T max and T min in February was 29.5°C and 19.4°C Mean daily percentage (p) of annual daytime hours was 0.29. (3 marks)
- Outline the factors that affect infiltration rates in a catchment. (5 marks)
- With the aid of a well labeled diagram, define and discuss the various stages and processes of a hydrological cycle. (8 marks)

QUESTION FIVE (20 MARKS)

- Explain the various conditions that you would consider in selecting a suitable position for installation of raingauges. (6 marks)
- After the installation, it was observed that one of the rain gauge (C) didn't function properly for a part of a month during which a storm occurred. However, the total and the normal annual precipitation for the other gauges were recorded and tabulated as shown in the table below. Find out the missing storm precipitation data of station (C). (4 marks)

Rain gauge	A	B	C	D	E
Total precipitation (mm)	28	45	?	56	38
Annual precipitation (mm)	395	430	367	495	462

- Problems associated with groundwater over exploitation. (4 marks)
- By use of a well labeled diagram, explain the occurrence of ground water with special emphasis on the zones of occurrence. (6 marks)