



A Constituent College of Kenyatta University

**UNIVERSITY EXAMINATIONS 2010/2011 ACADEMIC YEAR**

**INSTITUTIONAL BASED PROGRAMME**

**3<sup>RD</sup> YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF**

**ENVIRONMENTAL SCIENCE**

**COURSE CODE/ TITLE: ENS 351: ENVIRONMENTAL HYDROLOGY**

**END OF SESSION III**

**DURATION: 3HRS**

**DAY/TIME: MONDAY 7.00AM – 10.00AM**

**DATE: 01.08.2011- S2**

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**INSTRUCTIONS:**

Answer ALL questions in Section A and any Two questions in Section B

**SECTION A**

**Question One**

- a. Briefly explain the concern of environmental hydrology. **(2marks)**
- b. State any three sub-surface processes of interest in hydrology. **(3marks)**
- c. Define the term precipitation. **(1mark)**
- d. List any two forms of precipitation **(1mark)**
- e. Due to vandalism of equipment, precipitation data for station Z for the month of March were missing. Three close stations A,B, and C recorded monthly means of 65,78 and 69mm respectively for March. Their annual precipitation means are 1300, 1000 and 900mm respectively. If the annual mean for station Z is 1200 mm, estimate the mean precipitation for the month of March. **(3marks)**

## Question Two

- a) State any three factors that influence run-off generation. **(3marks)**
- b) With the aid of a simple labeled sketch, define the following flows:  
i) Hortonian flow  
ii) Baseflow  
iii) Return flow **(4marks)**
- c) A thunder storm having an intensity of  $50\text{mm hr}^{-1}$  falls on a  $400\text{-m}^2$  parking lot. What is the expected peak run-off rate ( $Q_{pk}$ ) in  $\text{m}^3/\text{s}$  if the run-off ratio is 0.88? **(3marks)**

## Question Three

- a. Define the following terms pertaining to ground water:  
i) An aquifer **(1mark)**  
ii) An aquitard **(1mark)**
- b. Differentiate between a homogenous and an isotropic aquifer. **(2marks)**
- c. State any three ecological functions of ground water **(3marks)**
- d. Calculate the flow rate into a gravity well 0.4m in diameter if the depth of the aquifer is 40m, the drawdown 0.5m, soil hydraulic conductivity 80m/day and radius of influence 200m. **(3marks)**

## Question Four

- a. Define the following terms as used in hydrology;  
i) Interception  
ii) Throughfall **(2marks)**
- b. State any three channel characteristics that control the depth and volume of flow in a channel. **(3marks)**
- c. Clearly differentiate between the terms, 'evaporation' and 'evapotranspiration' as used in environmental hydrology. **(2marks)**
- d. A swimming pool has a length of 50m and width of 25m. the class A pan evaporation for July was recorded as 17.0 cm. if the pan coefficient is 0.80, determine the monthly water loss from the pool due to evaporation. **(3marks)**

## SECTION B: Attempt any Two questions

### Question Five

- a. The hydrologic cycle has no beginning or end, but since most of the water involved is in the ocean, it is convenient to describe it as starting from the oceans. Using a well labeled diagram, define and describe the cycle.

**(10marks)**

- b. Why is it important to understand the hydrologic cycle? Give five reasons.

**(5marks)**

### Question Six

- a)
- i. With respect to a catchment, write the general form of the hydrologic (water balance) equation. **(1mark)**
- ii. Explain any three applications of the hydrologic equation. **(3marks)**
- b) A reservoir has a surface area of 69 hectares. The following table shows the monthly inflows and outflows from the reservoir via various means:

Month	inlet Inflow, (cm)	Spillway outflow, (cm)	Precipitation (cm)	evaporation (cm)	net change (cm)	elevation (cm)
						701
Dec	1732	175	2.75	1.05		
Jan	1755	190	3.05	1.55		
Mar	875	232	3.76	2.05		
Apr	955	375	4.11	2.80		
May	708	525	2.70	3.75		
Jun	312	955	1.05	4.25		
Jul	102	1720	0.75	5.15		
Aug	37	2250	1.25	5.76		
Sep	175	1575	1.55	4.92		
Oct	575	550	3.79	3.02		
Nov	1250	175	4.53	1.75		
Dec	1875	125	5.01	0.60		

Compute;

- i) The reservoir elevation at the end of each month. **(3marks)**
- ii) The change in the reservoir volume over the year. **(2marks)**
- c. Discuss any three methods by which the underground water reservoir can be artificially recharged. **(6marks)**

### Question Seven

a) Explain how a rating curve (stream gauging) is developed and used to measure the discharge of a river. **(4marks)**

b) The table below shows the results measurements of the depth and velocities across a straight stretch of a stream. Compute the discharge of the stream.

Dist,m	0	2	4	6	8	10	12	14	16	18	20	22
Depth, m	0	1	4.3	7.2	8.5	7.4	5.6	4.7	3.5	2.1	1.4	0
Vel (0.2d)	0	1.4	1.9	2.6	2.9	2.7	2.5	2.3	2.1	1.8	1.5	0
Vel (0.8d)	0	0.7	1.2	1.8	2.0	1.9	1.7	1.5	1.3	1.1	1.0	0

**(8marks)**

c) Using labeled sketches, differentiate between a 'losing' and a 'gaining' stream. **(3marks)**

### Question Eight

a. Clearly describe the causes and consequences of any five hydrologic hazards. Give specific examples. **(10marks)**

b. Describe any five measures that are used in flood control. **(5marks)**