



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE

SET 322: HYDROLOGY

DATE: FRIDAY, 2ND DECEMBER 2011

TIME: 11.00 A.M. – 1.00 P.M.

Answer Question One and any other two Questions

$$e_s = 4.584 \exp \left(\frac{17.27T}{237+T} \right)$$

Question One (30 marks)

- (a) (i) Define the term in the water balance equation

$$I - Q = \frac{dS}{dt} \quad (3 \text{ marks})$$

- (ii) In a given month, a 300 acre lake has an inflow of 20m³/s, an outflow of 18m³/s and a total storage increase of 16 acre–m. A raingauge next to the lake recorded a total of 130mm precipitation for the lake for the month. Determine the evaporation loss over the lake for the month (6 marks)

- (b) (i) Define the following terms:

I Relative Humidity

II Normal Lapse rate

III Adiabatic Lapse rate

(3marks)

- (ii) Explain the forces which act on a rain drop in the atmosphere. (6 marks)

- (iii) Briefly explain the factors that affect evaporation. (6 marks)

- (c) i) Define infiltration? (4 marks)

- (ii) What are the factors that affect infiltration? (5 marks)

Question 2 (20 marks)

- (a) (i) Explain briefly 3 types of rainfall forming mechanisms. Illustrate your answer (6 marks)
- (ii) Explain the process of condensation. (5 marks)
- (iii) Explain briefly how Radar and Satellite systems are used in measurement of rainfall. (6 marks)
- (iv) Explain briefly the three stage of a tropical cyclone. (3 marks)

Question 3

- (a) The penman equation for estimation of open water surface evaporation is given as:

$$E_0 = \frac{\Delta H + \gamma E_a}{\Delta + \gamma} \quad E_a = 0.35 \left(0.5 + \frac{u_2}{100} \right) (e_s - e_a)$$

- (i) Define the terms in the equation (7 marks)
- (ii) Use the Penman equation to calculate E_0 , given $u_2=124$ miles/day, $H=3.84$ mm/day
Mean Temperature= 19^0C and $\frac{\Delta}{\gamma}=2.11$ (6marks)
- (b) i) Define transpiration (1 mark)
- (ii) Explain briefly how physiological factors affect transpiration. (4 marks)
- (c) i) Compute the daily evaporation from a USA class A pan if the daily rainfall and the amount added to bring the water level in the pan to the fixed point are as follows:

Day	1	2	3	4	5	6
Rain fall (mm)	0	5	1	0	0	4
Water added (mm)	15	17	5	12	7	13

(3 marks)

Question 4

- (a) Horton's model for infiltration capacity given as

$$f(t) = f_c + (f_0 - f_c)e^{-kt}$$

- (i) Name the terms in the equation (3 marks)
- (ii) Sketch to the model (3 marks)
- (b) A watershed has the following Horton parameters
 - $f_0 = 15 \text{ mm/hr}$, $f_c = 2 \text{ mm/hr}$, $k = 0.35/\text{hr}$
 - (i) Determine $f(t)$ at time $(t) = 10\text{min}, 30\text{min}, 6\text{hrs}$ (6marks)
 - (ii) Determine the total infiltration after 6 hrs (3marks)
- (c) (i) Explain how infiltration can be measured using a double ring infiltrometer. (5 marks)

Question 5

- a) Explain how the following factors influence runoff
 - (i) Basic characteristics (6 marks)
 - (ii) Storm characteristics (4 marks)
- (b) Using gases and temperature distribution in the atmosphere explain and illustrate the various atmospheric subdivisions. (10 marks)
