

**W1-2-60-1-6**

## JOMO KENYATTA UNIVERSITY

**OF**

**AGRICULTURE AND TECHNOLOGY**

# University Examinations 2018/2019

**SECOND YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN LAND RESOURCE PLANNING AND MANAGEMENT**

**ALP 2203 : PRINCIPLES OF HYDROLOGY**

**DATE: APRIL 2019 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER**

**THREE QUESTIONS.**

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**QUESTION ONE (30 MARKS)**

(a) A USA Class A pan in Juja gave the depth of water reading in the pan of 195mm at the start of the week. In the same week, there was rainfall of 50mm and 15mm of water was removed from the pan to adjust the water level. If the depth of water in the pan at the end of the week was 185mm, estimate the evaporation in Juja for that week. Assume pan coefficient of 0.7. [3 marks]

(b) Outline the factors which affect evaporation. [3 marks]

(c) (i) Explain using a sketch, the infiltration process and its zones in a soil profile.

[6 marks]

(ii) Outline the factors which affect the rate of infiltration. [2 marks]

(iii) The infiltration parameters obtained in an infiltration experiment in Juja soils are f0 = 15mm/h, fc = 2mm/h, k = 0.35/h. Calculate the infiltration rate after 10 and 30 minutes respectively. [3 marks]

(d) Outline the goals of water demand management. [4 marks]

(e) Explain briefly how you can separate base flow from storm runoff. [4 marks]

**QUESTION TWO (15 MARKS)**

(a) (i) Define a watershed. [1 mark]

(ii) Outline at least two major Kenyan watersheds and briefly explain their

characteristics. [6 marks]

(iii) Explain the factors that affect the characteristics of a watershed. [5 marks]

(b) Using a sketch, explain the characteristics of a stream flow hydrograph from:

[3 marks]

(i) A small watershed.

(ii) A large watershed.

**QUESTION THREE (15 MARKS)**

(a) Discuss in details a water gauging expedition highlighting the preparation, equipment and the gauging. [5 marks]

(b) The following data was collected during a gauging expedition in River Thiba:

|  |  |  |  |
| --- | --- | --- | --- |
| Distance from bank(b) | Depth d(m) | Velocity (M/s) | |
| At 0.2d | At 0.8d |
| 0 | 0 | 0 | 0 |
| 1.5 | 1.3 | 0.6 | 0.4 |
| 3 | 2.5 | 0.9 | 0.6 |
| 4.5 | 1.7 | 0.7 | 0.5 |
| 6 | 1 | 0.6 | 0.4 |
| 7.5 | 0.4 | 0.4 | 0.3 |
| 9 | 0 | 0 | 0 |

Calculate the river discharge using the mean section method. [10 marks]

**QUESTION FOUR (15 MARKS)**

(a) Using a sketch diagram, discuss the components of a stream flow hydrograph.

[5 marks]

(b) Given below is a 2-hour Unit Hydrograph (UH) for a basin. Compute: [10 marks]

(i) The S-Hydrograph.

(ii) 4-hour UH.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Hour | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 |
| 2hr UH | 0 | 150 | 500 | 610 | 450 | 320 | 220 | 140 | 80 | 40 | 10 | 0 |

**QUESTION FIVE (15 MARKS)**

(a) What is the probability that a five-year flood will occur at least once during the next:

[5 marks]

(i) 5 years and

(ii) 25 years respectively?

(b) The record of annual maximum discharge (Q) at a stream gauging station is as follows:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 |
| Q(m3/s | 45.3 | 27.5 | 16.8 | 41.1 | 31.2 | 19.9 | 22.7 | 59 | 35.4 |

Calculate:

(i) The mean and standard deviation of the data. [2 marks]

(ii) The parameters of the Extreme Value Distribution Type I and fit the

distribution. [5 marks]

(iii) Obtain the return period of a discharge of 42.5 m3/s. [3 marks]