



# TECHNICAL UNIVERSITY OF MOMBASA

---

FACULTY OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**UNIVERSITY EXAMINATION FOR:**  
**BACHELOR OF SCIENCE IN CIVIL ENGINEERING**

ECE 2410 : HYDROLOGY II

END OF SEMESTER EXAMINATION

**SERIES: DECEMBER 2016**

**TIME: 2 HOURS**

**DATE: 15 Dec 2016**

### **Instructions to Candidates**

You should have the following for this examination

- Answer Booklet, examination pass and student ID
- Drawing instruments.
- Calculator.

This paper consists of five questions.

Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**



**Question One (Compulsory) (30marks)**

- a) Explain the term “DR Hydrograph” (3marks)
- b) Define a Unit Hydrograph. (2marks)
- c) Using illustrations, briefly discuss the components of stream flow hydrograph. (8marks)
- d) Outline the factors that determine the nature of a flood hydrograph. (8marks)
- e) Define the following; i) Form factor ii) Circularity ratio iii) Elongation ratio. (3marks)
- f) For a rectangular basin with a single drainage channel centrally located and flowing along the longer side of the basin; (Length= 15km, Width =10km). Calculate;
  - i) Form factor
  - ii) Circularity ratio
  - iii) Elongation ratio. (6marks)

**Question Two (20marks)**

- a) For a catchment with an area of 60km<sup>2</sup>, the main stream 11 km long and the distance from the catchment outlet to the point on the stream nearest to the centroid of the catchment is 4 km. Values of  $C_p = 0.6$  and  $C_t = 1.5$ . Derive a 2-h UH. Sketch the UH (12marks)
- b) What is a Synthetic Unit Hydrograph? (4marks)
- c) Describe the assumptions underlying the unit hydrograph theory. (4marks)

**Question Three (20marks)**

- a) Using the Muskingum approach, route the flood hydrograph given below through the channel reach and derive the outflow hydrograph. Take values of  $x$  and  $K$  as 0.278 and 12 hours respectively.

Time hr.	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56
Flow m <sup>3</sup> /s	42	68	116	164	194	200	192	170	150	128	106	88	74	62	54

(14marks)

b) Describe the step by step determination of a design flood of any frequency or probability.

(6marks)

**Question Four**

**(20marks)**

a) Briefly describe flow routing.

(5marks)

b) A reservoir has the following elevation, discharge and storage relationships.

Elevation (m)	Storage ( $\times 10^6 \text{ m}^3$ )	Outflow discharge ( $\text{m}^3/\text{s}$ )
100.00	3.350	0
100.50	3.472	10
101.00	3.880	26
101.50	4.383	46
102.00	4.882	72
102.50	5.370	100
102.75	5.527	116
103.00	5.856	130

When the reservoir level was at 100.50 m, the following flood hydrograph entered the reservoir.

Time (hrs)	0	6	12	18	24	30	36	42	48	54	60	66	72
Discharge ( $\text{m}^3/\text{s}$ )	10	20	55	80	73	58	46	36	55	20	15	13	11

Route the flood and obtain;

i) The outflow hydrograph.

ii) The reservoir elevation vs time curve during the passage of the flood wave. (15marks)



**Question Five**

**(20marks)**

- a) Define a flood.  
(2marks)
- b) Briefly describe the major factors responsible for initiating and modifying floods.  
(6marks)
- c) Outline the measures for mitigating and reducing flood damage.  
(12marks)

