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
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
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) 30 Marks
a) (i) Discuss the concept of the synthetic unit hydrograph

(ii) Two catchments A and B are considered meteorologically similar. The catchment characteristics are given below

Characteristics	**Catchment A**	**Catchment B**
L	30 km	45 km
Lca	15 km	25 km
A	250 Km2	400 Km2

For catchment A, a 2-h unit hydrograph was developed and was found to hav a peak discharge of 50m3/s. The time to peak from the beginnig of the rainfall excess in this unit hydrograph is 9.0 hr. Using Snyder's method, develop a unit hydrograph for catchment B.

(12 marks)

b) (i) Describe the two main categories of flood routing.

(ii) Briefly explain the terms "attenuation" and "translation" with respect to flood routing

(6 marks)

c) (i) Briefly explain the limitations of the unit hydrograph

(ii) The six-hour unit hydrograph of a watershed having a drainage area equal to 393 km^2 is as follows:

Time (h)	0	6	12	18	24	30	36	42
Unit Hydrograph (m3/s*cm)	0	1.8	30.9	85.6	41.8	14.6	5.5	1.8

The storm over the watershed has an excess rainfall of 5cm for the first six hours and 15 cm for the second six hours. Compute the streamflow hydrograph, assuming a constant baseflow of 100m^3 /s (12 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

a) With an appropriate sketch, draw and label different components of a storm hydrograph. (6 marks)

b) By broadly grouping factors that influence shape of runoff hydrographs into two, briefly discuss how they influence those hydrographs. (8 marks)

QUESTION THREE (20 Marks)

a) Briefly discuss two principles that form the basis of unit hydrograph theory. (6 marks)

b) (i) The six-hour unit hydrograph of a watershed having a drainage area equal to 393 km^2 is as follows:

Time (h)	0	6	12	18	24	30	36	42
Unit Hydrograph (m3/s*cm)	0	1.8	30.9	85.6	41.8	14.6	5.5	1.8

For a storm over the watershed having excess rainfall of 5cm for the first six hours and 15 cm for the second six hours;

(i) Compute the streamflow hydrograph, assuming a constant baseflow of 100m^3 /s.

(ii) Sketch the hydrographs

(14 marks)

QUESTION FOUR (20 Marks)

a) Describe the following hydrologic terms:
(i) linearity
(ii) Time invariance
(iii) Return period
(iv) Rising Limb (6 marks)

b) (i) Explain the objective of hydrologic frequency analysis of data (2 marks)

(ii) Explain the data characteristics necessary for frequency analysis (4 marks)

c) An average rainfall of 16 cm occurred over a catchment during a period of 12 hour with uniform intensity. The UH duration of 6h in the catchment rises linearly from 0 to 30 cumecs in 6 hours and then falls linearly from 30 to 0 in the next 12 hours. The phi-index of the catchment is 0.5 cm/hr. The base flow in the river is 5 cumecs.

(i) Calculate the peak discharge of the resulting run-off

(ii) Calculate the discharge of the flood hydrograph

(iii) Area of the catchment (8 marks)

QUESTION FIVE (20 Marks)

a)(i) Explain watershed changes that may influence frequency of flood flows.
(ii) If a flood of 1.2 m or greater occurs on average once every 10 years, what is the probability it will not occur for the next 8 years? (8 marks)

Year	Discharge (m^3/s)	Year	Discharge (m^3/s)	Year	Discharge (m^3/s)	Year	Discharge (m^3/s)
1950	1090	1961	507	1972	1651	1983	1254
1951	1580	1962	1303	1973	716	1984	430
1952	487	1963	197	1974	286	1985	260
1953	719	1964	583	1975	671	1986	276
1954	140	1965	377	1976	3069	1987	1657
1955	1583	1966	348	1977	306	1988	937
1956	1642	1967	804	1978	116	1989	714
1957	1586	1968	328	1979	162	1990	855
1958	218	1969	245	1980	425	1991	399
1959	623	1970	140	1981	1982	1992	1543
1960	804	1971	49	1982	277	1993	360
						1994	348

b) Consider the annual maximum discharge of a river for in the above table

(i) Develop a model for annual maximum discharge frequency analysis using Extreme Value Type-I distribution and

(ii) Calculate the 20 year and 100 year return period maximum annual discharge values.
(12 marks)