TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2402: HYDROLOGY I

END OF SEMESTER EXAMINATION

SERIES:APRIL2016

TIME:2HOURS

DATE:16May2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Q1. (COMPULSORY)

a) Calculate the discharge and average current velocity for a stream with slope S = .0001 and rectangular cross section that is 10 m wide and 3 m deep. Assume that the stream bed is very smooth so that n = 0 .01. **(4 marks)**

b) State Dalton's law of evaporation and discuss the significance of each parameter in Dalton's equation. **(6 marks)**

c) During a severe flood it was not possible to actually measure the discharge of a river. The discharge site was visited at a later date and the following section parameters were collected:

	Area of section (m^2)	Wetted perimeter (m)	Rugosity coefficient (n)
Section 1-1	208	67.3	0.045
Section 2-2	203	58.5	0.045

(i) The length of reach between sections 1-1 and 2-2 was 120 m.

(ii) The difference of high water marks was 0.97 m.

(iii) Using slope-area method calculates the highest discharge that passed through the river.

(10 marks)

d) Briefly describe the area velocity method of measuring discharge (**6 mark**s)

e) Explain two possible types of errors encountered in precipitation data **(4 marks)**

(CHOOSE ANY TWO QUESTIONS)

Q2.

a) In order to compute the flood discharge in a stream by the slope-area method the following data was obtained.

	Upstream Section	Middle Section	Downstream Section
Area (m2)	108.6	103.1	99.8
Wetted Perimeter (m)	65.3	60.7	59.4
Gauge reading (m)	316.8	-	316.55

Determine the flood discharge assuming Manning's n=0.029 given the length between the upstream and downstream section is 250m. (**8 marks**)

b) A catchment has the following annual precipitation for six rain gauge stations.

STATION	A	B	C	D	E	F
RAINFALL(mm)	826	1029	1803	11103	988	1367

Determine the required number of optimum rainfall stations in the catchment for precipitation with 10%, 5% and 2% errors. (**8 marks)**

c) (i) Briefly working principle of a rain gauge. (4 **marks**)

Q3.

a) Discuss factors affecting evapotranspiration process. **(8 marks)**

b) Evaluate the actual evaporation, if 10 litres of water is removed from an evaporation pan of diameter 122 mm, to maintain the stipulated water level in the pan. A rainfall of 10mm has been recorded simultaneously. The Pan coefficient is 0.9 for the evaporation pan. **(6 marks)**

c) Explain stream gauging **(6 marks)**

Q4.

a) The table below shows the annual precipitation at five stations in a watershed. Data at station A is suspect. Using appropriate means determine the suspect periods. Determine the possible correct 1967 annual precipitation at station A.

	Annual Precipitation for Station (mm/year)				
Year	**A**	**B**	**C**	**D**	**E**
1965	894	1016	834	1244	1082
1966	764	840	1114	1048	1076
1967	912	1142	1100	1312	1142

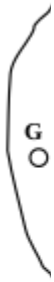
1968	804	1086	884	942	1126
1969	646	988	998	1228	858
1970	1588	996	1696	1450	1510
1971	1258	1050	1302	1090	1308
1972	826	732	890	804	1084
1973	1272	882	982	1134	1234
1974	1036	1130	836	1310	1220
1975	1164	852	962	1074	888
1976	1032	1200	1066	1200	1248
1977	1378	1378	1178	1060	1252
1978	1274	1118	1356	1130	1354
1979	1374	1062	1302	1350	1286
1980	936	938	874	868	1008

(**8 marks)**

b) Define the following terms;

(i) Aquifer
(ii) Permeability
(iii) Porosity **(6 marks)**

b) Referring to the adjacent figure. The table below shows the normal precipitation for the month of August at eleven gauges in a flat interior watershed. During a storm event which occurred on August 15, 2015, gauge D failed. Estimate the most likely the precipitation at gauge D during the storm event in mm /day giving reasons for any assumptions made.



Site	August normal precipitation mm/month	August 17, 2006 precipitation in mm/day
A	6.5	1.3
B	2.1	3.8
C	4.7	0.8
D	1.1	6.2
E	5.3	2
F	1.4	6.4
G	5	2.1
H	--	6.6

I	4.9	2.2
J	1.1	7.2
K	5.1	2.7

(**6 marks)**

Q5.

a) Briefly explain the Evaporation process (**6 marks)**

b) With aid of a sketch explain the subsurface zones related to movement of rainwater **(8 marks)**

c) Explain how a double-mass curve can be used to test the inconsistencies of a rain gauge. (**6 marks)**