TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DECREE IN:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)

ECE 2410: HYDROLOGY II

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
- *Pocket Calculator*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
Use neat, large and well labeled diagrams where required
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Describe the assumptions underlying the unit hydrograph theory **(5 marks)**

b) The runoff data at a stream gauging station are given below:

Day	Time	Flow m^3/s	Day	Time	Flow m^3/s
1	4	48	3	4	216
	8	48		8	192
	16	690		16	152
	20	640		20	136
	24	560		24	120
2	4	488	4	4	104
	8	424		8	88
	12	368		12	72
	16	320		16	64

	20	280		20	56
	24	240		24	48

The drainage area is 1200km^2. The duration of rainfall is 4 hours. Assuming a base flow of 48m^3/s derive the 4-hour unit hydrograph for the basin and plot the same **(12 marks)**

c) The data in the table represent observed inflow and outflow flood hydrograph for a channel reach:

Time in hours	0	12	24	36	48	60	72	84	96	108	120	132
I in m^3/s	22	35	103	109	86	59	39	28	22	20	19	18
O in m^3/s	22	21	34	55	75	85	80	64	44	30	22	20

Assuming x = 0.4, derive the Muskinum constant K for the reach **(13 marks)**

Question Two

a) In a stream the base flow is observed to be 61.2m^3/s on the June 6 and 33.5m3/s on June 17. If there is no rain in June what would be:

(i) The base flow on June 27

(ii) The volume of water in ground water storage on June 2 and June 30 **(5 marks)**

b) The following data represent the ordinates of hourly interval of one unit hydrograph

Time in Hours	0	1	2	3	4	5	6	7	8	9	10	11	12	13
UH ordinates m^3/s	0	52	99	86	48	23	13	6	5	4	3	1	1	0

Compute storm hydrograph resulting from three storm rainfall as:

Time	First Hour	Second Hour	Third Hour
Rainfall Depth	4	3	2.5

Take $\phi = 2cm/hr$ and assume base flow of 2 cumecs **(11 marks)**

c) Describe how physiographic factors affect the shape of hydrographs **(4 marks)**

Question Three

a) Describe steps for determining Muskingum routing coefficient K and X **(6 marks)**

b) In a river, the following inflow hydrograph was recorded. Route the hydrograph in the reach when K = 10hours, X = 0.25, initial outflow = 10m^3/s, also find the attenuation of peak flow and log of peak time.

Time in Hours	0	6	12	18	24	30	36	42	48	54	60	66
Inflow in hours	10	25	50	75	80	74	65	50	40	30	20	10

c) Describe advantages of hydraulic routing method **(2 marks)**

Question Four

a) The maximum annual flows in a river for the period 1997 to 2011 are given in the following table:

Year	Flow m^3/s	Year	Flow m3/s
1997	3400	2005	2000
1998	5100	2006	6200
1999	4300	2007	3400
2000	2100	2008	2100
2001	8200	2009	2050
2002	7050	2010	3040
2003	5500	2011	4050
2004	4500		

Compute 100 years average return period of flood using Gumbel method. The frequency factor K for 100-year return period for Gumbel distribution is given as 4.005. **(7 marks)**

b) Describe step by the determination of design flood of any frequency or probability **(6 marks)**

c) Describe assumptions made during the derivation of Saint-Vennant Equations for hydraulic routing **(5 marks)**

d) Define river routing and state its importance **(2 marks)**

Question Five

a) Describe the step by step procedure of the derivation of a unit hydrograph from a simple flood hydrograph of isolated storm **(5 marks)**

b) Describe how direct surface runoff can be computed from flood hydrograph by radiants of recession limb of a hydrograph method. **(5 marks)**

c) Describe the limitations of the application of unit hydrograph theory **(6 marks)**

d) Discuss storage reservoirs as a measure to mitigate flood disaster **(2 marks)**

e) Describe the relationship of outflow and storage **(2 marks)**