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 2402: HYDROLOGY I

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 formation of Orographic rainfall **(4 marks)**

b) With the aid of a diagram, explain the principle of a mechanism of the float rain gauge. What are its advantages and disadvantages **(5 marks)**

c) Describe radar measurement of rainfall **(6 marks)**

d) Describe with the aid of a sketch US weather Bureau class A surface pen **(5 marks)**

e) The annual rainfalls in cm at a station for a period of 15 years from 1991 to 2005 is as follows:

Year	Rainfall (cm)	Year	Rainfall (cm)	Year	Rainfall (cm)
1991	97	1996	119	2001	98
1992	125	1997	103	2002	83

1993	103	1998	79	2003	105
1994	81	1999	102	2004	123
1995	101	2000	118	2005	100

(i) Represent this data in form of chronological chart

(ii) Construct a 5 year moving average curve and super impose it on the chronological chart

(iii) Comment on the moving average **(10 marks)**

Question Two

a) Discuss the points considered when selecting a raingauge site **(5 marks)**

b) The network of 10 stations in and around a river basin has the Thiessen weights of 0.10, 0.16, 0.12, 0.11, 0.09, 0.08, 0.07, 0.11, 0.06 and 0.10 respectively. Station 2, 4 and 5 lie outside the basin while the remaining are inside. If the rainfalls recorded at these gauges during a storm are 160, 178, 168, 145, 166, 217, 148, 172, 124 and 142mm respectively. Determine the average depth of rainfall over the basin by arithmetic and Thiessen mean methods. Determine the volume of surface runoff at the basin outlet if 45 per cent of rainfall is lost as infiltration. Take the area of the basin as 3200km **(5 marks)**

c) A storm commenced at 10.00 hours. The ordinates of the rainfall mass curve of this storm in mm as recorded by a recording rain gauge at 15 minute intervals are 0, 23, 38, 58, 85, 102, 130, 172, 194, 208, 224, 228, and 228.

(i) Compute the maximum rainfall intensities for durations of 30, 60, 90, 120, 150 and 180 minutes

(ii) Plot the maximum intensity duration graph **(10 marks)**

Question Three

a) Describe FIVE meteorological factors affecting evaporation **(5 marks)**

b) A reservoir has average area of 30km^2. In the month of April, mean rate of inflow is 15m^3/s, mean outflow is 22.5m^3/s, rainfall is 13cm and change of storage is 24 x 106m^3. Assuming surface losses to be 27cm, estimate the evaporation **(6 marks)**

c) A reservoir has an average area of 57.5km^2 over a year. Normal annual precipitation is 138cm and evaporation from class A pan is 276cm. Assuming the land flooded by the reservoir has a runoff coefficient of 0.46 and a pan coefficient of 0.7, estimate the net annual increase or decrease in the stream flow as a result of the reservoir **(5 marks)**

d) The following data were obtained from a weather station:

- Reservoir area 2km^2
- Water temperature = 25^{o}C and e_s at this temperature = 23.75mm of mercury
- Wind velocity = 12km per hour
- Barometric reading = 752mm of mercury
- Relative humidity = 46 per cent
- C = 0.50 (for small reservoir)

Estimate by Meyer's equation:

(i) Daily evaporation

(ii) Volume of water evaporated in a week of seven days **(3 marks)**

Question Four

a) Describe SIX physiographic factors affecting runoff **(5 marks)**

b) The current meter observations taken during a stream gauging of a stream are as follows:

Distance from Bank (m)	Depth of flow (m)	Meter Depth (m)	No of Revolutions	Time in Seconds
0.8	0.5	0.30	12	48
1.6	1.0	0.80	23	52
		0.20	36	51
2.4	1.6	1.28	27	54
		0.32	41	60
3.0	2.0	1.60	33	58
		1.40	45	62
3.6	2.0	1.60	32	58
		0.44	44	60
4.2	1.8	1.44	28	53
		0.36	42	58
5.0	1.2	0.96	24	50
		0.24	35	50
5.8	0.6	0.36	14	45
6.6	0.0			

Take the current meter rating as $V = 0.05 + 0.3N$, where V is in m/s and N is in revolutions per second
Compute the discharge in the stream **(15 marks)**

Question Five

a) Describe with the aid of a sketch, the principle of working of syman's non-recording rain gauge **(5 marks)**

b) Describe a procedure of finding average rainfall using isohyetal method **(5 marks)**

c) Discuss plant factors affecting transpiration from a plant **(4 marks)**

d) Discuss rating curve method as a process of determining flow in a stream **(4 marks)**

e) What role does hydrological data play in hydroelectric power planning **(2 marks)**