(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2015/2016 ACADEMIC YEAR**

SECOND YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DIPLOMA
IN
CIVIL AND STRUCTURAL ENGINEERING**

COURSE CODE: DCE 077

COURSE TITLE: HYDROLOGY

DATE: Monday 14ᵀᴴ December 2015   TIME: 9.00 – 11.00 AM

INSTRUCTIONS:
1. This paper consists of FIVE Questions
2. Answer any FOUR Questions
3. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

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Question One

a) The isohyets for annual rainfall over a catchment were drawn and the areas enclosed by the isohyets are given below. Determine the average depth of annual rainfall over the catchment. **[6 Marks]**

Isohyet (cm)	40	35	30	25	20	15	10
Area enclosed (km^2)	-	20	70	150	320	450	600

b) A class A pan set up to a lake. The depth of water in the pan at the beginning of a certain week in the year 2014 was 195mm. In that week, there was a rainfall of 45mm and 15mm of water removed from the pan to keep the water level within the specified depth range. If the depth of the water in the pan at the end of the week was 190mm, estimate the lake evaporation in that week. Assume pan coefficient is 0.7 **[5 marks]**

c) The hourly precipitation data during a storm are as follows

Time (h)	0	1	2	3	4	5	6	7	8	9	10
Precipitation (mm)	0	30	25	50	5	0	10	15	25	20	0

Plot the mass curve **[5 marks]**

d) Determine the return period of rainfall whose probability of exceedance is 20% **[3 marks]**

Question Two

a) For a small catchment, the infiltration rate at the beginning of rain was observed to be 100mm/hr and decreased exponentially to a constant rate of 12mm/hr after 3 hours. The total infiltration during 3 hours was 60mm. Develop the Horton's equation for the infiltration rate at any time t<3 hr **[5 marks]**

b) A 3-hour storm occurred at a place and the precipitations in the neighbouring rain-gauge stations *P*, *Q* and *R* were measured as 3.8, 4.1 and 4.5 cm, respectively. The precipitation in the neighbouring station *S* could not be measured since the rain-gauge bottle was broken. The normal precipitation in the four stations *P, Q, R* and *S* were 45, 48, 53 and 50 cm, respectively. Estimate the storm precipitation at station *S*. **[5 marks]**

c) The annual rainfall at a place for a period of 10 years from 2005 to 2014 are respectively 30.3, 41.0, 33.5, 34.0, 33.3, 36.2, 33.6, 30.2, 35.5, 36.3. Determine the mean, median and 3-yr moving averages for the data **[7 marks]**

d) Outline factors that affect rate of infiltration **[3 marks]**

Question Three

a) Using a suitable sketch, Outline the main components of an hydrograph **[8 marks]**

b) The classification of a catchment covering an area of 150km^2 is as follows;
Urban – 20%, Forest – 35%, Commercial and industrial – 30%, Concrete pavement – 15%

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Using the rational formula, find the annual runoff from the catchment when the average annual precipitation is 900mm. assume runoff coefficients are 0.25, 0.45, 0.9 and 0.85 for urban, forest, commercial and industrial, and concrete pavements respectively

[6 marks]

c) The surface area of a reservoir in m^2 is given by $A = 100y^2$, where y is the depth of water in metres in the reservoir. In one week, the water depth in the reservoir has reduced from 10 to 9m. find the average hourly rate of evaporation. Assume seepage loss to be 40% of the evaporation loss **[6 marks]**

Question Four

a) Explain the Darcy law **[3 marks]**

b) A 0.4m diameter well fully penetrates an unconfined aquifer whose bottom is 80m below the undisturbed ground water table. When pumped at a steady rate of $1.5m^3$/min, the drawdowns observed in two observation wells at radial distance of 5m and 15m are, respectively, 4m and 2m. Determine the drawdown in the well [**7 marks**]

c) The river gauging measurements in Table below were carried out by wading on River Mkombozi. Calculate the flow by Mean-Section Method **[10 marks]**

Chainage (m)		0	0.61	1.21	1.82	2.43	3.04	3.65	4.26	4.87	5.48	6.09	6.70
Depth d(m)		0	0.24	0.82	1.95	2.59	2.19	1.73	0.97	1.00	0.64	0.33	0
Velocity	0.2d	0	0.30	0.51	0.79	0.88	0.82	0.73	0.70	0.70	0.54	0.45	0
(m/s)	0.6d	0	0.24	0.42	0.64	0.70	0.67	0.61	0.57	0.61	0.45	0.36	0

Question Five

a) Using a suitable sketch, illustrate the main processes in the hydrological cycle

[6 marks]

b) The catchment area of an irrigation tank is $100km^2$. The constant water spread during October 2014 was $5km^2$. During that month, the uniform precipitation over the catchment was recorded to be 100mm. 60% of the precipitation reaches the tank. The irrigation canal discharges at a uniform rate of $1.5m^3$/s in the month of October. Assuming seepage losses to be 40% of the evaporation losses, find out the daily rate of evaporation for October 2014 **[8 marks]**

c) Discuss the importance of measurements of discharge in the study of hydrology

[6 marks]