MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCES (CITY CAMPUS)

NES 827: LAKE VICTORIA WATER QUALITY & ECOSYSTEM

Date: 25th April, 2012   Time: 9.00 – 12.00 noon

INSTRUCTIONS:

♦ Answer ANY FOUR questions.

1. (a) The following table gives 29 years total rainfall recorded at the rain gauge station at Sena in Mufangano Island of lake Victoria, Kenya.

Year	Rainfall
1971	646
1972	887
1973	435
1974	635
1975	675
1976	617
1977	643
1978	512
1979	986
1980	395
1981	474
1982	537
1983	848
1984	606
1985	876
1986	688
1987	788
1988	1036
1989	545
1990	733
1991	818
1992	428
1993	855
1994	522
1995	1048
1996	870
1997	6530
1998	593
1999	910

Using the weibull's ranking procedure determine the rain that may be equalled or exceeded at least once in

(i) 2 years   (3 marks)

(ii)5 years   (2 marks)

(iii)   10 years   (3 marks)

(b) Analysis of data on maximum one day rainfall depth of the Maseno indicated that a depth of 280mm had a return period of 50 years. Determine the probability of a one-day rainfall depth equal to or greater than 280mm at Maseno occurring.

(i) Once in 20 successive years   (3 marks)

(ii)Twice in 15 successive years   (2 marks)

(iii)At least once in 20 successive years   (2 marks)

2. (a) The failure to control water hyacinth in Lake Victoria of Kenyan side is more of the political aspect than the professional. Discuss?   (7 marks)

(b) Discuss the environmental impacts of water hyacinth in Lake Victoria

                                                                    (8 marks)

3. A municipal wastewater treatment plant serving a city of 200,000 people discharges 1.10 m^3/s of treated effluent having an ultimate BOD of 50.0 mg/L into a stream that has a flow of 8.70 m^3/s and a BOD of its own equal to 6.0 mg/L. The deoxygenation constant K_d is 020/day

(a) Assuming complete and instantaneous mixing, estimate the ultimate BOD at the river just down stream from the outfall.

(b)   If the stream has constant cross section so that it flows at a fixed velocity equal to 0.30m/s, calculate the BOD of the stream at a distance 30,000m downstream.   (20 marks)

4. A pond has the following characteristics

Volume = 50,000m^3

Surface area = 25,000m^2

Mean depth = 2m

Inflow = outflow = $7500m^3 d^{-1}$

The pond's inflow has a temperature of 20^0c. The net heat gain from the atmosphere is $250cal\ cm^{-2}\ d^{-1}$. If there is no other heat exchange, calculate the steady stage temperature. (15 marks)

(b) A contaminant has a pore water concentration of $10mgl^{-1}$ at the sediment water interface. If it has a half life of 10 years, how far will it penetrate into the sediments if

$\not{c}D = 0.9 \times 10^{-5} cm^2 5^{-1}$ and $Vb - 2mm\ yr^{-1}$? (5 marks)

5. (a) The failure to control water hyacinth in lake Victoria of Kenyan side is more on the political aspect than the professional. Discuss the above statement? (7 marks)

(b) Discuss eutrophication of lake Victoria (4 marks)

(c) Explain ways in which phosphorous differs from nitrogen as nutrient in water bodies. (4 marks)

6. Asila and Omwenga (1987) presented the following data related to the solid budget for lake Nakuru

Volume = $1666 \times 10^9 m^3$

Solids loading = $4.46 \times 10^{12} gyr^{-1}$

Area = $19.485 \times 10^6 m^2$

Suspended solids concentration = $0.5\ myL^{-1}$

Flow = $212 \times 10^9 m^3 yr^{-1}$

They assumed that solids settle at a rate of $2.5md^{-1}$ ($912.5myr^{-1}$) and that the sediments have

$\rho = 2.4\ gcm^{-3}$ and $\not{c} = 0.9$. Determine the burial and suspension velocities by a mass balance approach. (15 marks)