



**MASEÑO UNIVERSITY**  
**UNIVERSITY EXAMINATIONS 2015/2016**

**FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE  
DEGREE OF MASTER OF SCIENCE IN ENVIRONMENTAL  
SCIENCE**

**CITY CAMPUS**

**NES 827: FRESH WATER QUALITY**

Date: 28<sup>th</sup> April, 2016

Time: 2.00 - 5.00pm

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**INSTRUCTIONS:**

- Answer ANY FOUR Questions.

1. a) A lake has the following characteristics

$$\text{Volume} = 1 \times 10^7 \text{m}^3$$

$$\text{River inflow} = 1 \times 10^6 \text{m}^3 \text{d}^{-1}$$

$$\text{River outflow} = 0.8 \times 10^6 \text{m}^3 \text{d}^{-1}$$

Suppose that a first - order decaying ( $0.2 \text{yr}^{-1}$ ) dissolved pollutant is discharged to this system at a constant rate of mass loading of  $1 \times 10^7 \text{g yr}^{-1}$

Calculate the lake concentration if the discrepancy between inflow and outflow is due to;

- i) Groundwater loss *(3mks)*
- ii) An evaporation loss *(3mks)*

b) A contaminant has a pore water concentration of  $10 \mu\text{g/L}$  at the sediment - water interface. If it has a half - life of 10 years how far will it penetrate into the sediment if  $D = 0.9 \times 10^{-5} \text{cm}^2 \text{yr}^{-1}$  and  $V_b = 2 \text{mmyr}^{-1}$ ? *(9mks)*

2. a) Explain how solids in natural waters from drainage basin and photosynthesis process differ. *(3mks)*

- b) A lake with surface area equal to  $80 \times 10^6 \text{m}^2$  is fed by a stream having an average flow of  $15 \text{m}^3/\text{s}$  and an average total phosphorous concentration of  $0.01 \text{mg/L}$ . In addition, treated effluent from a waste water treatment plant adds  $0.2 \text{m}^3/\text{s}$  of flow having  $5 \text{mg/L}$  total phosphorus. The phosphorous settling rate is at  $10 \text{m/year}$ .
- Calculate the average total phosphorous concentration *(8mks)*
  - What rates of phosphorous removal at the waste water treatment plant would be required to keep the concentration of phosphorous in the lakes at an acceptable level of  $0.01 \text{mg/L}$ . *(3mks)*
  - Why is it important in eutrophication control to focus on phosphorous only *(1mk)*
3. a) Discuss the biological control of water hyacinth. *(8mks)*  
 b) Discuss the environmental impacts of water hyacinth. *(7mks)*
4. Just below the point where a continuous discharged of pollution mixes with a river, the BOD is  $10.9 \text{mg/L}$  and DO is  $7.6 \text{mg/L}$ . The river and waste mixture has a temperature of  $20^\circ\text{C}$ , a deoxygenation constant of  $0.2/\text{day}$ , an average flow speed of  $0.3 \text{m/s}$ , and an average depth of  $3 \text{m}$ .
- Find the time and distance downstream at which the oxygen deficit is a maximum *(8mks)*
  - Find the minimum value of DO. *(7mks)*
5. The following table gives 29 years total rainfall (mm) recorded at the rain gauge station at Sena in Mfangano Island of Lake Victoria.

Year	Rain
1981	646
1982	887
1983	435
1984	635
1985	675
1986	617
1987	643
1988	512
1989	986
1990	395
1990	474
1991	537

1992	848
1993	606
1994	876
1995	688
1996	788
1997	1036
1998	545
1999	733
2000	818
2001	428
2002	855
2003	522
2004	1048
2005	870
2006	530
2007	593
2008	910

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

- a) 2 years *(5mks)*
- b) 5 years *(5mks)*
- c) 10 years *(5mks)*

6. Discuss watershed management of Lake Victoria drainage basin. *(15mks)*