

NATIONAL UNIVERSITY OF SINGAPORE

ESE5001 –ENVIRONMENTAL ENGINEERING PRINCIPLES

(Semester II: AY2014/2015)

Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. Please write your student number only. **Do not write your name.**
2. This assessment paper contains **THREE PARTS** and comprises **FIVE** printed pages:
 - Part A (Water Treatment) consists of **THREE** questions.
 - Part B (Air Quality) consists of **THREE** questions.
 - Part C (Waste Management) consists of **THREE** questions
3. Answer **ALL** questions. All questions DO NOT carry equal marks.
4. Answer each Part at a new answer book.
5. This is a “CLOSED BOOK” assessment.

PART A: WATER TREATMENT [30 MARKS]

- a) Given a domestic wastewater with the following characteristics (below), propose a suitable wastewater treatment process scheme with targets of BOD₅ and SS removal. State your rationale.

BOD₅=250 mg/l
 COD=500 mg/l
 TSS=200 mg/l
 Org-N=10 mg/l
 Ammonia-N=20 mg/l
 TP=10 mg/l

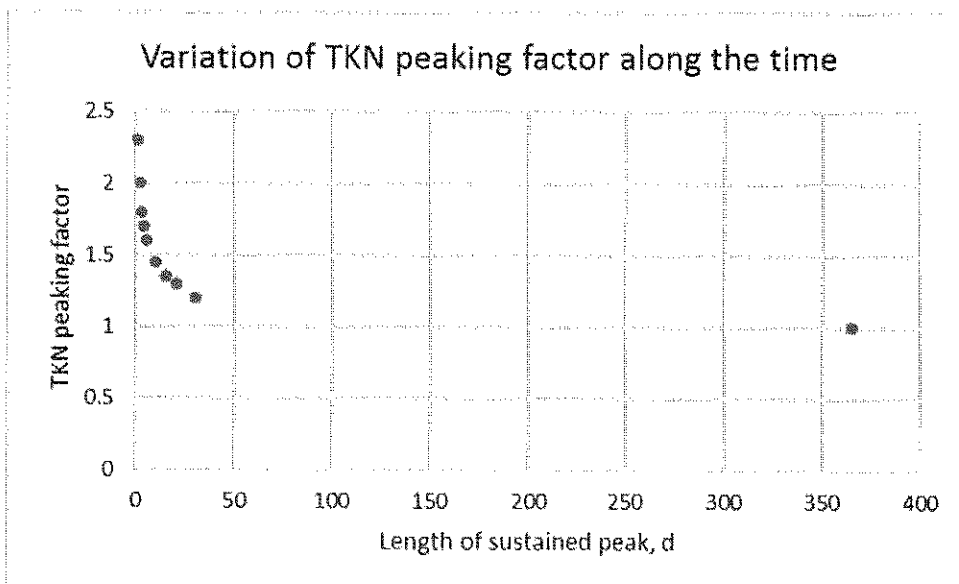
[7 marks]

- b) Using an ASP process diagram and derived mathematical relationship, explain how to improve the performance of this process by controlling the key operational parameter, mean cell residence time. You may like to use the equation in Appendix 1.

[13 marks]

- c) Develop a sustained TKN peak mass loading curve for 30 days for a wastewater treatment plant with a design flowrate of 1.5 m³/s. The long term daily average ammonia-N and organic-N concentrations are 15 and 25 mg/l, respectively. The following variation of TKN peaking factors with the time is applicable.

[10 marks]



APPENDIX 1

$$\mu = \frac{\mu_m S}{K_s + S} - K_d$$

PART B: AIR QUALITY [30 MARKS]

- (a) Briefly summarize the steps resulting in the Antarctic ozone hole and its recovery. Explain why the ozone dent (i.e. ozone loss in tropical and mid-latitudes) is never so severe as the ozone hole.
[10 marks]
- (b) Identify and discuss two arguments against and two arguments for global warming.
[10 marks]
- (c) Discuss three possible effects of climate change. Would any of these effects affect your life or lifestyle?
[10 marks]

PART C: WASTE MANAGEMENT [30 MARKS]

- a) Discuss how solid waste composition may affect the ways that solid waste is to be managed?
[10 marks]
- b) Compare the major advantages and disadvantages of biological treatment and incineration methods used in solid waste management.
[10 marks]
- c) In some parts of the world, people consider and try to manage the organic waste placed in a landfill as a FUTURE source of fuel. Explain the reason and how this waste-to-fuel conversion can be made possible.
[10 marks]

- END OF PAPER -