

UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Sciences

BSc Environmental Health

MAIN EXAMINATION PAPER DECEMBER 2013

TITLE OF PAPER : INDUSTRIAL WASTE MANAGEMENT I
COURSE CODE : EHS:553

DURATION : 2 HOURS

MARKS : 100

INSTRUCTIONS : THERE ARE FIVE QUESTIONS IN THIS EXAM
: ANSWER ANY 4 OF THE 5 QUESTIONS
: EACH QUESTION CARRIES 25 MARKS
: NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE
EXAMINATION ROOM
:

EHS 553
DECEMBER 2013

QUESTION ONE (25 Marks)

1A. The BOD measurement of an industrial flow effluent was made over a period of 9 days. The data are shown in the table below. Make a plot of the BOD against the probability of non-exceedence (%) and determine:

- i) The median BOD concentration.[9 Marks]
- ii) The BOD concentration that has a 90% probability of non-exceedence.....[8 Marks]
- iii) The BOD concentration that has 100% probability of non-exceedence ... [8 Marks]

Sample	1	2	3	4	5	6	7	8	9
BOD (mg/L)	875	650	1075	1225	787.5	562.5	500	912.5	1150

QUESTION TWO (25 Marks)

- 2A.** Using a flow chart diagram, arrange the following pre-treatment units in sequence.
- Source control, spill basin, filtration, oil separation,
neutralization, coagulation, floatation, equalization
.....[4 Marks]
- 2B.** State the different objectives for which an equalization tank may be provided for industrial waste treatment[4 Marks]
- 2C.** Compare intuitive/judgmental sampling with statistical/probability based sampling with respect to the following criteria:
i) Reproducibility of results.
ii) Ease of implementation
iii) Data requirement[4 Marks]
- 2D.** Describe the advantages and disadvantages of the following measurements for organic matter in industrial wastewater samples:
i. BOD [2 Marks]
ii. COD[2 Marks]
iii. TOC[1 Mark]
- 2A.** Discuss the variation in the removal efficiency of oil and grease with pH using dissolved air floatation system.[4 Marks]
- 2E.** (1 Marks each)
i. Define the following terms: a) laboratory blank b) field blank c) matrix spikes.
ii. Determine the sources of uncertainty in measurements..
iii. Describe the consequences of unreliable measurements.
iv. Define traceability in analytical measurements

QUESTION THREE (25 Marks)

- 3A.** Describe the advantages and disadvantages of lagoon systems for the treatment of industrial wastewaters.....[4 Marks]
- 3B.** Differentiate among the following types of oils. i) free oil ii) physical emulsion iii) chemical emulsion iv) dissolved oil.[4 Marks]
- 3C.** Describe the role and advantages of surfactants in the removal of hydrophobic and non-aqueous liquid phase contaminants.[4 Marks]
- 3D.**
- i) State the causes of short circuiting and hydraulic instability in primary settlement tanks.[2 Marks]
 - ii) What are the consequences of short circuiting and hydraulic instability in primary settlement tanks?[1 Mark]
 - iii) Discuss how short circuiting and hydraulic instability may be minimized.....[2 Marks]
- 3E.** List the methods utilized for:
- i. Dewatering of sludge solids[3 Marks]
 - ii. Drying of sludge solids[2 Marks]
- 3F.**
- i) What are the advantages of providing grit chambers and primary settlement tanks at the same time?.[2 Marks]
 - ii) What is the problem if too long a detention time is provided in primary settlement tanks?[1 Mark]

QUESTION FOUR (25 Marks)

- 4A.** Discuss the characteristics of waste generated from pharmaceutical industries
.....[4 Marks]
- 4B.** Describe methods for the removal of volatile organic carbon from
i) Polluted air
ii) polluted water and
iii) polluted soil[4 Marks]
- 4C.** Describe the amphoteric properties of metals and the implication on the removal of metals
by precipitation from industrial wastewaters.[4 Marks]
- 4D.** Describe the chemical method for the removal of cyanide from cyanide bearing
wastewaters[4 Marks]
- 4E.** List the different methods of neutralization of acidic industrial wastes
.....[4 Marks]
- 4F.** State the types of industries that may produce wastewater containing Cadmium and the
method of removal of Cadmium from such wastewaters[5 Marks]

QUESTION FIVE (25 Marks)

- 5A.** Describe the factors that must be considered when selecting chemical oxidation processes for industrial waste treatment[4 Marks]
- 5B.** Describe the oxidation mechanism of Hydrogen peroxide/Fenton's reagent and the scope of application to industrial waste treatment.[4 Marks]
- 5C.** Discuss the source of fluoride in industrial wastewaters and the methods of treating wastewaters that contain Fluoride.[4 Marks]
- 5D.** Describe the oxidation mechanism of wet air oxidation and the scope of application to industrial waste treatment.[4 Marks]
- 5E.** Discuss the objective of pretreatment before ion exchange process and the technologies used for pretreatment.[4 Marks]
- 5F.** Describe with the help of a sketch the application of ion exchange for the removal of chromium from wastewater generated from plating industries.[5 Marks]

