

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

**BSc Environmental Health**

**MAIN EXAMINATION PAPER DECEMBER 2015**

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

**DURATION** : 2 HOURS

**MARKS** : 100

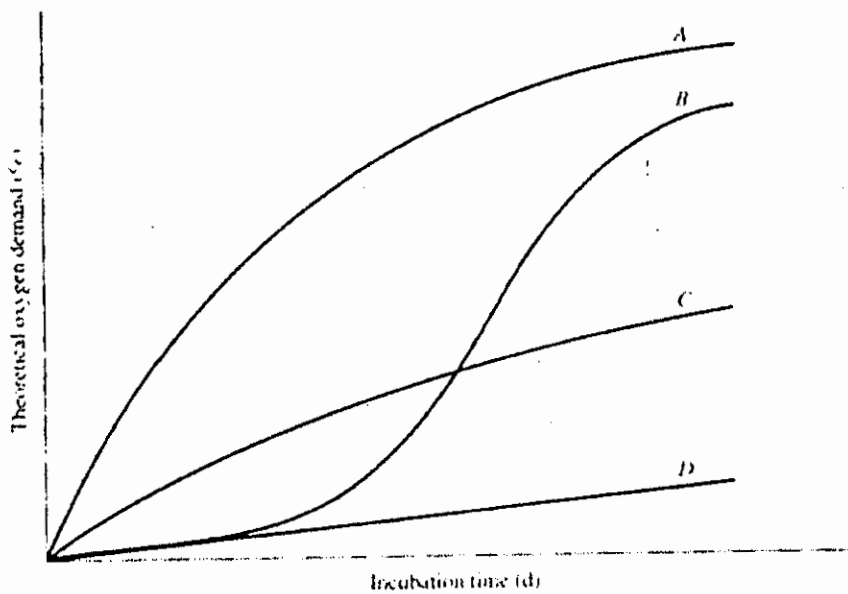
**INSTRUCTIONS** : THERE ARE FIVE QUESTIONS IN THIS EXAM  
: ANSWER ANY 4 OF THE 5 QUESTIONS  
: EACH QUESTION CARRIES 25 MARKS  
: NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE  
EXAMINATION ROOM

EHS 553  
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**QUESTION ONE (25 Marks).** Each question carries 5 marks

- 1A.** The frequently used parameters for assuring quality of laboratory analysis of industrial wastewater are accuracy and precision. In the context of such analysis describe how you may be able to improve upon each of this criterion?
- 1B.** Choose the appropriate sampling techniques for each of the following cases.
- i) There is large difference in sample properties
  - ii) There is small difference in sample properties
- 1C.** Describe the treatment methods employed for the removal of impurities from piggery wastewaters.

The diagram below shows the characteristics of the BOD among different industrial wastewater sampling that underwent BOD test. Differentiate among the test results A, B, C and D shown in the figure.



- 1D.** Differentiate between chronic and acute bioassay tests.
- 1E.** List methods used for effluent fractionation of industrial wastes to identify toxicity characteristics.

**QUESTION TWO (25 Marks).** Each question carries 5 marks

- 2A.** Describe the advantages and disadvantages for the following treatment methods for the treatment of industrial wastes:
- i. Physical treatment techniques
  - ii. Chemical treatment techniques
- 2B.** Discuss the feasibility of applying composting for the treatment of hazardous industrial wastes.
- 2C.** List the different targets used in bioassay test used to assess the toxicity of industrial wastes.
- 2D.** Describe the physico-chemical techniques used for the treatment of pharmaceutical wastes.
- 2E.** Describe the biological methods used for the treatment of pharmaceutical wastes

**QUESTION THREE (25 Marks).** Each question carries five marks

- 3A.** List the typical contaminants present in the following industries:
- i. Breweries
  - ii. Pharmaceutical
  - iii. Tanneries
- 3B.** What are the most important physical parameters used to characterize industrial wastewaters?
- 3C.** List the in-plant treatment methods available for the treatment of wastes from pesticides industries. Describe the types of pollutants that each method removes.
- 3D.** Describe the treatment methods available for the treatment of wastes from soap and detergent manufacturing industries.
- 3E.** Describe the treatment method for the removal of impurities from the wastewater generated during dyeing of textile industries.

**QUESTION FOUR (25 Marks).** Each question carries 5 marks.

- 4A.** Describe the basin configuration and construction features of equalization basins.
  
- 4B.** Describe the characteristics of oils that may be generated in industrial wastewaters.
  
- 4C.** List five industries that are major contributors of fat, oil and grease to wastewater treatment plants.
  
- 4D.** Differentiate between solid thickening and dewatering techniques used for the processing of industrial waste solids. What are the technologies used for each process?
  
- 4E.** What are the possible causes of short circuiting in sedimentation tanks intended for solids removal from industrial wastes?

**QUESTION FIVE (25 Marks).** Each question carries 5 marks.

- 5A.** Give example of industrial waste that can be treated by coagulation.
- 5B.** List the heavy metal removal technologies available to remove heavy metals from industrial wastes.
- 5C.** Describe the advantages and disadvantages of the following oxidation processes for the treatment of industrial wastes:
- i. Hydrogen peroxide
  - ii. Fenton's reagent
  - iii. Chlorine
- 5D.** Describe the chemical treatment process employed for the removal of cyanide from cyanide bearing industrial wastes.
- 5E.** Describe the wet air oxidation process and indicated the types of industrial wastes that can be treated by the wet air oxidation process.