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**UTHM**  
Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2023/2024**

- COURSE NAME : WASTEWATER TREATMENT TECHNOLOGY
- COURSE CODE : DAK 20802
- PROGRAMME CODE : DAK
- EXAMINATION DATE : JULY 2024
- DURATION : 2 HOURS
- INSTRUCTIONS :
1. ANSWER ALL QUESTIONS
  2. THIS FINAL EXAMINATION IS CONDUCTED VIA
    - Open book
    - Closed book
  3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

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- Q1** Wastewater, generated from various domestic, industrial, and agricultural activities, poses significant environmental and public health challenges worldwide.
- (a) Describe your understanding of the term 'wastewater'.  
(2 marks)
  - (b) State four (4) objectives of wastewater treatment.  
(4 marks)
  - (c) Sewers are underground pipes or channels designed to collect and convey wastewater, stormwater, or a combination of both from residential, commercial, industrial, and institutional sources to a wastewater treatment plant. Differentiate between combined and separated sewers.  
(4 marks)
  - (d) Wastewater treatment typically involves several processes to remove pollutants before the treated wastewater can be safely discharged into the environment or reused.
    - (i) Describe the general processes involved in a preliminary treatment.  
(8 marks)
    - (ii) Explain the primary sedimentation process in wastewater treatment.  
(7 marks)
- Q2** (a) A wastewater treatment plant is designed to handle an average flow rate of 10,000 m<sup>3</sup>/day. To remove grit from the incoming wastewater, a rectangular grit chamber is employed. The design criteria dictate that the grit chamber should have a flow-through velocity of 0.3 m/s and a sand particle settling velocity of 0.050 m/s. The depth of the grit chamber is 1.5 m.
- (i) Calculate the cross-sectional area required for the grit chamber.  
(3 marks)
  - (ii) Calculate the width of the grit chamber.  
(3 marks)
  - (iii) Calculate the detention time for a particle to fall the entire tank depth chamber.  
(3 marks)
  - (iv) Determine the length to achieve the detention time in **Q2(b)(iii)**.  
(3 marks)

- (b) A wastewater treatment plant is designed to treat an average flow rate of  $0.16 \text{ m}^3/\text{s}$  of domestic wastewater. The rectangular primary sedimentation tank is designed to provide an overflow rate of  $50 \text{ m}^3/\text{m}^2\cdot\text{day}$ . Given the depth of the tank is 3 m and the weir length is 65.0 m.
- (i) Calculate the surface area required for the primary sedimentation tanks.  
(4 marks)
  - (ii) Calculate the detention time in the primary sedimentation tanks.  
(5 marks)
  - (iii) Determine the weir loading rate in  $\text{m}^3/\text{m}\cdot\text{day}$ .  
(4 marks)

**Q3** Biological treatment processes involve the removal of organic contaminants from industrial and municipal wastewater.

- (a) Nitrification is a natural process in the environment where specialized bacteria convert ammonia into nitrites and then nitrates.
  - (i) Demonstrate the mechanisms of the nitrification process.  
(4 marks)
  - (ii) List three (3) elements that influence the effectiveness of denitrification.  
(3 marks)
  - (iii) Distinguish between nitrification and denitrification processes.  
(4 marks)
- (b) Fixed growth in biological treatment refers to the growth of microorganisms that are attached to a support medium, such as plastic or rocks, within the treatment system.
  - (i) List two (2) examples of fixed growth systems available in the wastewater treatment industry.  
(2 marks)
  - (ii) Elaborate on each system mentioned in **Q3(b)(i)**.  
(4 marks)
  - (iii) Differentiate the mechanisms of anaerobic and aerobic digestion.  
(8 marks)

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- Q4** Sludge is the residual solids from wastewater treatment. Sludge treatment and disposal are major factors in the design and operation of all wastewater treatment plants.
- (a) Identify four (4) major heavy metals commonly discovered in digested sludge.  
(4 marks)
- (b) Proper handling, treatment, and disposal of sludge is crucial to minimize environmental impact.
- (i) Illustrate the unit processes and process flow involved in handling sludge in a wastewater treatment facility.  
(7 marks)
- (ii) Interpret the four (4) unit processes mentioned in **Q4(b)(i)**.  
(8 marks)
- (c) Explain three (3) categories of sludge sources that the wastewater treatment facility produces.  
(6 marks)

- END OF QUESTIONS -

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