



**THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY**

Department of Civil Engineering

**SECOND SEMESTER EXAMINATION 2022**

Final Year Bachelor of Engineering in Civil Engineering

Subject Code: **CE422**

Subject Name: **PUBLIC HEALTH ENGINEERING**

Date: **Thursday 27<sup>th</sup> October, 2022**

Time: **8:30 am to 11:30 am**

Venue: **Structures Lecture Theatre (SLT)**

**Examination Instructions**

1. **NO MOBILE PHONE** is allowed in the examination room.
2. You have 10 minutes to read the paper.
3. Fill-in the answer slip. **DO IT NOW.**
4. There are five questions. All questions worth 20 marks each. **ANSWER ALL FIVE QUESTIONS.**
5. Write your answer in the answer booklet provided.
6. Do not consult your notes. Students caught cheating will be removed from the examination room and will get a zero mark.

### Question 1

- (a) What are the nine physical characteristics of water and wastewater? Provide brief explanations. (10 marks)
- (b) Can you explain logically what is pH? Use formulae also to justify your answer. (5 marks).
- (c) What is Oxidation Reduction Potential or ORP? (5 marks)

### Question 2

- (a) What is the formula for bicarbonate, carbonate and hydroxide? (3 marks)
- (b) Explain alkalinity and why is it useful in water? (2 marks)
- (c) How is calcium bicarbonate formed and what is the formula? (5 marks)
- (d) How does acidity affect water and wastewater? (5 marks)
- (e) What is hardness of water? Explain. (3 marks)
- (f) What is Dissolved Oxygen (DO) and why it is important in water quality? (2 marks)

### Question 3

- (a) Explain what is Oxygen Demand, BOD and COD and how are they related? (10 marks)
- (b) How is nitrogen important in biological system? (3 marks)
- (c) How does chloride affect water and wastewater? (2 marks)
- (d) What are the typical standard for drinking water parameters for total solids, pH, turbidity, colour taste and odour, according to World Health Organisation? (5 marks)

#### Question 4

Draw a flow diagram of the water treatment plant in Lae which is operated by Water PNG Limited and explain the processes involved in sourcing, treating and supplying of clean water.

(20 marks)

#### Question 5

(a) During a recuperation test the water in an open well was dispersed, by pumping by 3 m and it recuperated 2 m in 90 minutes. Find;

[i] yield from a well of 4 m diameter under a head of 3 m

[ii] the diameter of the well to yield 12 litres per second under a head of 2.5 m.

(10 marks)

(b) Design a tube well for the following data;

[i] Yield required = 0.1 cumecs

[ii] The thickness of confined aquifer = 25 m

[iii] Radius of confined aquifer = 250 m

[iv] Permeability coefficient = 70 m/day

[v] Draw down = 6 m.

(10 marks)

---

**End of Examination**