



THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

EXAMINATION QUESTION PAPER MASTER

PROFORMA

Semester: I Academic Year: 2021

A. DEPARTMENT SECTION

I ACCEPT THAT THIS EXAMINATION PAPER SATISFACTORILY EXAMINES

Subject Code: CE 421 Title: ENVIRONMENTAL ENGINEERING 1

Number of Questions: 07 Number of Pages: 3

1. Subject Examiner: DR. REVANURU SUBRAMANYAM
Signature: [Signature] Date: 07/06/2021

2. Subject Co-Examiner: Chris A. Kobal
Signature: [Signature] Date: 07/06/2021

3. Departmental Examinations Co-ordinator: Checked: YES NO (Please tick)
Signature: [Signature] Date: 07/06/21

4. Head of Department and Chief Examiner: Checked: YES NO (Please tick)
Comments:

NIL

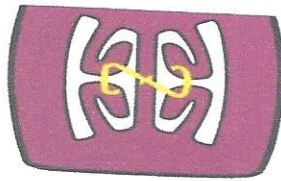
Signature: [Signature] Date: 08/06/2021

B. EXAMINATIONS OFFICE SECTION

Examination Masters Received: YES NO

5. Examinations Officer Signature: _____ Date: _____

6. Witness Signature: _____ Date: _____



THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

FIRST SEMESTER EXAMINATIONS – 2021

CE 421- ENVIRONMENTAL ENGINEERING I

FOURTH YEAR CIVIL ENGINEERING

Wednesday 9th JUNE 2021 – 12:50 PM

VENUE: C001/C002 – CIVIL ENGINEERING DEPARTMENT

TIME ALLOWED: 3 HOURS

INSTRUCTIONS FOR STUDENTS:

- 1. WRITE YOUR NAME AND ID NUMBER CLEARLY ON THE FRONT PAGE OF THE ANSWER SHEET.**
- 2. You have 10 minutes to read this exam paper. You must not begin writing during this time.**
- 3. All answers must be written on the answer booklet provided. No other written material will be accepted.**
- 4. Calculator only is allowed in the examination room. Notes and handouts are not allowed. MOBILE PHONE is not allowed.**
- 5. Maximum Marks: 100.**
- 6. Answer any FIVE questions. All questions carry equal marks.**
- 7. Number of pages is 3 including Cover page and Appendix.**

- Q1)** (i) Describe the infiltration well with help of a neat sketch. [10 Marks]
 (ii) What are objectives of a community water supply system? [5 Marks]
 (iii) What is methemoglobinemia? and discuss it as a water-related illness. [5 Marks]

- Q2)** (i) Define biochemical oxygen demand (BOD), chemical oxygen demand (COD) and total organic carbon (TOC). [3 x 3 = 9 Marks]
 (ii) With which waterborne pathogens are the following diseases associated?
 (a) Typhoid fever (b) Cholera (c) Polio (d) Amebic dysentery [6 Marks]
 (iii) What are the acceptable limits of the following according to WHO drinking water standards:
 (a) Copper (b) Hardness (c) Total residual chlorine (d) Colour (e) Total Coliform [5 Marks]

- Q3)** (i) Why is aeration used in water-treatment plants? Is it more commonly used with ground water or surface water? Why? [6 Marks]
 (ii) Name and describe any two commonly used water-in-air systems found in water purification plants. [10 Marks]
 (iii) Given the following jar test results, which polymer dose should be used? Why?

Container No.	1	2	3	4	5	6
Alum (mg/L)	4	4	4	4	4	4
Polymer (mg/L)	0.25	0.5	1.0	2.0	3.0	4.0
Turbidity (NTU)	0.9	0.7	0.4	0.3	0.7	1.0

[4 Marks]

- Q4)** (i) Population of a Port Moresby town as obtained from the census report is as follows.

Year	1980	1990	2000	2010	2020
Population	120,000	195,000	254,000	312,000	383,000

Estimate the population of the town in the year 2050 by

- (a) Arithmetic increase method (b) Geometrical increase method [10 Marks]
 (ii) Explain the various factors affecting the per capita demand. [10 Marks]

- Q5)** Draw a neat sketch of a rapid sand filter and describe how it works. [20 Marks]

Q6) (i) What are the advantages and disadvantages of ozone treatment? [4+2 = 6 Marks]

(ii) The maximum daily demand at a water purification plant has been estimated as 16 million liters per day. Design the dimensions of a suitable sedimentation tank for the raw supplies, assuming a detention period of 4 hours, depth of tank 4 m and the velocity of flow as 25 cm per minute. Draw the plan and cross-section. [14 Marks]

Q7) (i) Write short notes on the following with examples.

(a) Suspended-growth processes and (b) Attached-growth processes [4 x 2 = 8 Marks]

(ii) Design a course screen using the following information:

Peak design wet weather flow	=	60 MLD
Velocity through rack at peak weather flow	=	0.9 m/s
Velocity through rack at maximum design dry weather flow	=	0.6 m/s
$\theta = 60^\circ$, with a mechanical cleaning device.		
Upstream depth of wastewater	=	1.6 m
Select rectangular bars with sharp edged face, thus B	=	2.42
Assume w/b	=	1

[12 Marks]

---- End of Exam ----

APPENDIX

$$H = B \left(\frac{w}{b} \right)^{4/3} \frac{v^2}{2g} \sin \theta$$

$$P_n = P + ni$$

$$P_n = P (1+i/100)^n$$