1st QUESTION PAPER

EXTERNAL INTEGRATED SUMMATIVE ASSESSMENT (EISA)

OCCUPATIONAL CERTIFICATE: INDUSTRIAL WATER PROCESS CONTROLLER

SAQA ID: 102578 **NQF LEVEL: 5** **CREDITS: 251**

LEARNER DETAILS			
Surname:			
Name:			
ID Number:			
Centre Name:			
Date:		**Mark Allocation:**	**100 Marks**
Time:	**09H00 to 12H00**	**Duration:**	**3 Hours**

INSTRUCTIONS TO CANDIDATES

Please read the questions carefully and then answer all the questions on the provided answer sheets.

PLEASE ENSURE THAT YOU ADHERE TO THE FOLLOWING INSTRUCTIONS:

- Cell phones are not allowed.
- Please use a black pen. No script will be marked if written in Pencil.
- Complete all your personal details in the space provided above.
- This is a closed book assessment; no reference material will be allowed, unless otherwise indicated.
- Carefully read through all the case exercises and questions and answer all questions
- Read the instructions for each question before answering.
- Structure all written answers logically.
- Use the mark allocation for each written question to guide the length of your answer.
- If additional paper is used, ensure that you write your Personal Details on each page and clearly mark which question you are answering.
- The invigilators will supply you with a stapler to attach the additional pages to the ANSWER SHEET.

SECTION A:

Analyse, interpret and apply legislation, regulations, and standards applicable to industrial water treatment.

Time: **54** Min Maximum Marks – **30**

QUESTION 1: MULTIPLE CHOICE QUESTIONS (2 MARKS)

Choose the correct answer from the choices provided. Write the letter only.

1.1 What can you do to prevent forming of LEGIONELLA in industrial water systems (1)

A. Maintain proper disinfectant amounts
B. Maintain proper water temperatures
C. Prevent stagnation
D. All of the above
E. None of the above

1.2 Which type of waste is NOT restricted or prohibited in terms of disposal? (1)

A. Waste with a pH <6 or >12
B. Liquid waste with a moisture content of <40% and which has been stabilized by treatment
C. Brine or waste with a salt content > 100 000 mg/l
D. Waste with a Calorific Value of >6% TOC

Sub-Total Marks: (2)

QUESTION 2: CONSTRUCTED RESPONSE QUESTIONS (10 MARKS)

2. 1 **What is the definition of industrial effluent? (2)**

2. 2 **Which limitations exist on the disposal of industrial effluent into a municipal sewer? Under which conditions would a reapplication for industrial effluent discharge be required? (2)**

2. 3 **What are the objectives of Hazardous Waste handling before transportation (2) during transportation (2) and after (2) transportation? (6)**

Sub-Total Marks: (10)

QUESTION 3: EXTENDED CONSTRUCTED RESPONSE QUESTIONS (18 MARKS)

3.1. Describe what is meant by the Zero Liquid Effluent Discharge (ZLED) Philosophy, how it can be achieved, why it is necessary, and mention its two main objectives (6)

3.2. Calculate % compliance of the following results with the provided limits. Also indicate average, maximum and minimum values (12)

Determinant	Limit	Month 1	Month 2	Month 3	Average	Max	Min	% Compliance
pH	5.5 – 9.5	7.9	8.2	7.9				
TDS (mg/l)	450	467	563	538				
Sodium (mg/l)	90	87	93	105				

Sub-Total Marks: (18)

SECTION B:

Apply Safety and Emergency Protocols on an Industrial Water Treatment Plant.

Time: **18** Min Maximum Marks – **10**

QUESTION 1: MULTIPLE CHOICE QUESTIONS (2 MARKS)

Choose the correct answer from the choices provided. Write the letter only.

1. Which one of the following type of emergencies is not part of the emergency plan? . (1)

A. Fire & Explosion
B. Bomb threats & armed confrontations
C. Speeding on site
D. Medical emergency & Rescues
E. Hazardous chemicals and natural disasters

2. Why is a lockout necessary? Select the incorrect answer (1)

If a lockout is not performed uncontrolled energy could cause

A. Electrocution
B. Cuts, bruises or crushing from entrapment with belts, chains, conveyors, rollers, shafts, impellors, etc.
C. Flooding of an area
D. Fires & explosions
E. Chemical exposure (gases or liquids released from pipelines)

Sub-total Marks: (2)

QUESTION 2: CONSTRUCTED RESPONSE QUESTIONS (3 MARKS)

2. 1 Name the three risk assessment categories that should be considered when conducting a risk assessment at an industrial water treatment plant (3)

Sub-total Marks: (3)

QUESTION 3: EXTENDED CONSTRUCTED RESPONSE QUESTIONS (5 MARKS)

3.1. **Elaborate on aspects that need to be considered to ensure a pump is safely operated** **(5)**

Sub-total Marks: (5)

SECTION C:

Optimise, control and supervise all industrial water treatment processes.

Time: **90** Min | Maximum Marks – **50**

QUESTION 1: MULTIPLE CHOICE QUESTIONS (8 MARKS)

Choose the correct answer from the choices provided. Write the letter only.

1.1 What laboratory intervention is used to optimize the Clarifier? (1)

A. COD
B. Ion exchange
C. Jar Test
D. Titration
E. OA

1.2 What is the Formula for Mass Flow? (1)

A. $Q = VA$
B. $Q = V/t$
C. $Q = Vt^2$
D. $t = Q/V$
E. $V = Q/t$

1.3 Which of the following two (2) chemicals are used during the coagulation process? (1)

A. Aluminum Phosphate and Aluminum Sulphate
B. Aluminum Chloride and Aluminum Sulphate
C. Calcium Chloride and Sodium Chloride
D. Aluminum Sulphate and Calcium Chloride
E. Sodium Chloride and Aluminum Sulphate

1.4 What is the unbiased measurement of water balance, as defined by $CaCO_3$ saturation? (1)

A. RSI / CC
B. PSI / PP
C. LSI / CCPP
D. TSI / PCV
E. TDI / WV

1.5 What formation of unwanted material is deposited on heat transfer surfaces? (1)

A. Fouling & Scaling
B. Erosion
C. Corrosion
D. Dezincification
E. Pitting

1.6 What is the purpose of the conductivity online analysers? (1)

A. To determine the flow properties of water
B. To monitor the quality of the water treatment process
C. To measure salinity of the water
D. Only B and C are correct
E. A, B and C are correct

1.7 Why are chemicals added to Cooling Water? (1)

A to increase Cooling Tower longevity
B to prevent fouling and corrosion
C to prevent legionella formation over time
D A and B are correct
E A, B and C are correct

1.8 Which are not advantages of having control instrumentation? (1)

A. Give a continuous read-out on the operation processes and allow for automatic control of them
B. Improve the maintenance of the equipment and hence its availability
C. Provide for automatic shutdown if there is a mechanical failure or other untoward events
D. Simplify preventative maintenance programmes
E. None of the above

Sub-Total Marks: (8)

QUESTION 2: CONSTRUCTED RESPONSE QUESTIONS (10 MARKS)

2. 1 List two types of level measuring mechanisms **(2)**

2. 2 What are the main goals of process optimisation? **(3)**

2. 3 Define ion exchange **(3)**

2. 4 Define "Feedback Control" as it relates to process automation **(2)**

Sub-Total Marks: (10)

QUESTION 3: EXTENDED CONSTRUCTED RESPONSE QUESTIONS (32 MARKS)

3.1 Briefly discuss Coagulation. **(5)**

3.2 What is the purpose of Jar Testing? **(3)**

3.3 How is exhausted resin regenerated? **(2)**

3.4 How can Upflow Velocity be used to evaluate and troubleshoot the hydraulic loading of a settling tank? What is the formula for this calculation? **(3)**

3.5 Explain the backwashing process and factors that affect backwash efficiency **(3)**

3.6 Calculate the dosing rate (in ml/min) for flocculant dosing where the product needs to be dosed at 5 mg/l and is supplied as a 10% solution with a SG of 1.25. The flow through the plant is 375 m3/h **(4)**

3.7 Calculate the dosing in mg/l for a plant where chlorine gas is dosed at a rate of 15.75 kg/d (24 hours) and the flow through the plant is 375 m^3/h **(4)**

3.8 What is the difference between Ultrafiltration and Reverse Osmoses **(2)**

3.9 Name any two performance trends that indicate the need for a CIP be performed on an RO system? **(2)**

Answer

3.10 What are four measures to be taken to reduce the cost of chemical consumption during plant optimization? (4)

Sub-Total Marks: (32)

SECTION D:

Use applicable control systems and on-line analysers to control the Industrial Water Treatment Plant.

Time: **18** Min | Maximum Marks – **10**

QUESTION 1: MULTIPLE CHOICE QUESTIONS (2 MARKS)

Choose the correct answer from the choices provided. Write the letter only.

1.1 **What online platforms are used to control an Industrial Water Treatment Plant?** **(1)**

A. HMI
B. GSM
C. PCL, SCD, Telemetry System
D. PLC, SCADA, DCS, Telemetry System
E. Radio Control, Windows, HMI

1.2 **What is the Formula for Mass Flow?** **(1)**

A. $Q = VA$
B. $Q = V/t$
C. $Q = Vt^2$
D. $t = Q/V$
E. $V = Q/t$

Sub-Total Marks: (2)

QUESTION 2: CONSTRUCTED RESPONSE QUESTIONS (3 MARKS)

2.1 Define the term Calibration (3)

Sub-Total Marks (3)

QUESTION 3: EXTENDED CONSTRUCTED RESPONSE QUESTIONS (5 MARKS)

1.1. How can the validity of measurements be determined? (5)

GRAND TOTAL MARKS: 100