UNIVERSITI KUALA LUMPUR

MALAYSIAN INSTITUTE OF CHEMICAL AND BIO-ENGINEERING TECHNOLOGY

FINAL EXAMINATION

OCTOBER 2025 SEMESTER

COURSE CODE	:	CED22103
COURSE TITLE	:	AIR POLLUTION CONTROL TECHNOLOGY
PROGRAMME NAME	:	DIPLOMA IN CHEMICAL ENGINEERING TECHNOLOGY
DATE	:	25 JANUARY 2026
TIME	:	9:00AM - 12:00PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Section A consist 25 MCQ or EMQ questions. Answer ALL questions.
5. Section B consist of four questions. Answer THREE (3) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Please answer MCQ/EMQ questions using OMR sheet. ☐ *Tick if applicable*
9. Refer to the attached Formula/ Appendies. ☐ *Tick if applicable*

THERE ARE 11 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 25 marks)

Answer ALL questions.

Please use the objective answer sheet provided.

1. Select the statement that best represents the definition of air pollution

   A. Increase in temperature due to greenhouse gases

   B. Presence of visible smoke in urban areas

   C. Accumulation of solid waste in open spaces

   D. Modification of atmospheric characteristics by contaminants

2. Recognize the pollutant that is formed through atmospheric chemical reactions.

   A. Sulfur dioxide

   B. Carbon monoxide

   C. Volcanic ash

   D. Ground-level ozone

3. Identify the environmental impact connected to nitrogen deposition in water bodies.

   A. Crop damage

   B. Reduce visibility

   C. Acid rain

   D. Eutrophication

4. Apply the "Three E's" of management to determine which pillar involves public awareness campaigns to change behaviour.

   A. Enforcement

   B. Environment

   C. Engineering

   D. Education

5. Select the most appropriate role of a cyclone when installed upstream of a fabric filter.

   A. Chemical absorption unit

   B. Final gas polishing unit

   C. Gas cooling device

   D. Pre-cleaner for particulate removal

6. Apply the cut diameter concept to determine cyclone performance for particles smaller than the cut diameter.

   A. Collection efficiency remains constant

   B. Collection efficiency exceeds 90%

   C. Collection efficiency equals 50%

   D. Collection efficiency drops below 50%

7. Select the expected performance outcome when the cyclone cut diameter is reduced.

   A. Elimination of fine particle escape

   B. Decrease in dust removal efficiency

   C. Reduction in pressure drop only

   D. Improvement in dust collection performance

8. Select the best description of the motion of the gas stream inside a cyclone.

   A. Single circular rotation at constant radius

   B. Straight-line flow from inlet to outlet

   C. Vertical plug flow without rotation

   D. Several helical turns providing multiple wall impacts

9. Identify the operating mechanism that enables a baghouse to separate particulate matter from gas.

   A. Electrostatic attraction

   B. Filtration through porous fabric media

   C. Gravitational settling

   D. Centrifugal force

10. Choose the operational outcome most associated with a high gas-to-cloth ratio in a baghouse.

   A. Reduced collection efficiency at all particle sizes

   B. Lower fan energy consumption

   C. Longer bag life and less cleaning

   D. Faster bag clogging and more frequent cleaning

11. Select the parameter that directly increases when the resistance to airflow across a baghouse rises.

   A. Bag length

   B. Pressure drop

   C. Gas-to-cloth ratio

   D. Hopper volume

12. Identify the filtration behaviour observed once a dust cake forms on felt fabric.

   A. Collection efficiency decreases rapidly

   B. Dust cake acts as the primary filtering medium

   C. Fabric becomes impermeable to gas

   D. Particles pass directly through the fabric

13. Identify the Electrostatic Precipitator (ESP) component that must be supplied with high-voltage direct current.

    A. Discharge electrode

    B. Collection plate

    C. Hopper

    D. Gas outlet duct

14. In an ESP, a negative, high-voltage pulsating direct current is applied to the discharge electrode. Determine the direct effect of increasing this applied voltage up to the corona discharge level.

    A. The gas velocity decreases

    B. A strong negative electric field is created

    C. The hopper temperature increases

    D. The collection plates become positively charged

15. An engineer deals with particles larger than 1.0 μm in diameter in an ESP. Select the dominant charging mechanism for these particles.

    A. Gravitational charging

    B. Diffusion charging

    C. Field charging

    D. Thermal charging

16. Select the wet chamber type that removes particles primarily by collision with sprayed liquid droplets.

    A. Venturi scrubber

    B. Inpingement scrubber

    C. Bubbling scrubber

    D. Spray chamber

17. Select the monitoring outcome that supports evaluation of control measure performance.

    A. Identification of pollutant sources only

    B. Determination of hazardous concentration limits

    C. Estimation of meteorological variability

    D. Assessment of ameliorating measure effectiveness

18. A monitoring program aims to obtain time-averaged concentrations by collecting pollutants on a filter over 24 hours. Select the appropriate sampling category.

    A. Personal sampling

    B. Integrated sampling

    C. Area sampling

    D. Continuous sampling

19. Select the situation that best represents a fugitive emission source.

    A. Pollutants released unintentionally from leaking valves

    B. Emissions discharged through a stack with control equipment

    C. Exhaust gases released from combustion chambers

    D. Treated gases exiting a scrubber

20. Apply control strategy selection to identify an effective mitigation measure for fugitive dust.

    A. Gas recovery systems

    B. Leak detection and repair (LDAR)

    C. Water spraying and surface suppression

    D. Installation of electrostatic precipitator

21. Apply source classification to identify an odour released from a landfill surface.

    A. Building source

    B. Area source

    C. Stack source

    D. Point source

22. Select the odour control strategy that focuses on preventing odour formation at the source.

    A. Dispersion control

    B. Prevention

    C. Minimization

    D. Treatment

23. A panel sniffs source-sampled air directly to determine the dilution-to-threshold ratio. Identify this odor sampling technique.

    A. Passive diffusion tube sampling

    B. Continuous automated gas analyzer

    C. Direct odor sampling with olfactometer

    D. Indirect odor sampling

24. An office worker develops Legionnaire's Disease from a cooling tower. Examine the health effect category with clinically defined causes.

    A. Building Related Illness

    B. Sick Building Syndrome

    C. Environmental Tobacco Smoke effects

    D. Radon-induced cancer

25. Apply source identification to recognize an indoor pollutant originating from occupants.

A. Mold spores from damp walls

B. Exhaled carbon dioxide

C. Carbon monoxide from stoves

D. VOCs from furniture

SECTION B (Total: 75 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

A cement grinding plant generates a large amount of cement dust with fine particle sizes ranging from 1–10 µm during its operation. The existing dust control system is no longer able to meet the required emission standard.

(a) Select the most suitable air pollution control equipment for this application using analysis of the emission conditions.

(5 marks)

(b) Illustrate the working principle and main components of the selected equipment using a clearly labeled diagram.

(8 marks)

(c) Identify **TWO (2) methods** to increase the **collection efficiency** of the selected equipment.

(4 marks)

Outline **FOUR (4) advantages** and **FOUR (4) disadvantages** of the selected equipment for controlling cement dust emissions.

(8 marks)

Question 2

A chemical manufacturing facility has received repeated complaints of a strong and persistent odour originating from its packaging section. Employees working in the area report discomfort and nausea, particularly during operating hours.

(a) Classify the odour nuisance using the **FIVE (5)** dimensions of odour nuisance relevant to the situation described.

(15 marks)

(b) Analyse **FOUR (4)** suitable odour control strategies that could be applied to reduce the odour impact at the facility.

(10 marks)

Question 3

A three-storey office building has received multiple complaints from employees regarding headaches, eye irritation, fatigue, and difficulty concentrating, particularly during working hours. The symptoms improve after employees leave the building. The building is fully air-conditioned and has recently undergone interior renovation, including new carpets, furniture, and repainting.

(a) Determine **FIVE (5)** the possible indoor air pollution sources contributing to the reported symptoms in the building.

(10 marks)

(b) Determine **TWO (2)** difference between Sick Building Syndrome (SBS) and Building-Related Illness (BRI) based on the symptoms and conditions described in the scenario.

(7 marks)

(c) Analyse **FOUR (4)** appropriate strategies to improve indoor air quality and reduce occupant exposure in the building.

(8 marks)

Question 4

A natural gas processing facility has detected methane leaks around valves, flanges, compressors, and storage tanks during normal operation. These emissions occur outside stacks or vents and vary with equipment operation and maintenance activities. The facility is required to report and reduce its Scope 1 greenhouse gas emissions.

(a) Determine the nature and characteristics of fugitive greenhouse gas emissions.

(10 marks)

(b) Examine other major sources of fugitive greenhouse gas emissions in industrial activities, excluding those described in the scenario

(7 marks)

(c) Identify suitable control and mitigation measures to reduce fugitive greenhouse gas emissions from the facility.

(8 marks)

END OF EXAMINATION PAPER