



UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF CHEMICAL AND BIO-ENGINEERING TECHNOLOGY

FINAL EXAMINATION
OCTOBER 2025 SEMESTER

COURSE CODE : CPD 22703
COURSE TITLE : PLANT MAINTENANCE & INSPECTION
PROGRAMME NAME : DIPLOMA IN CHEMICAL ENGINEERING TECHNOLOGY
DATE : 02 FEBRUARY 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 14 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 25 marks)

Answer ALL questions.

Please use the objective answer sheet provided.

1. Identify the main function of a transformer in an electrical system.
 - A. Generate electricity
 - B. Convert AC to DC
 - C. Store electrical energy
 - D. Change voltage level

2. Explain why AC induction motors are widely used in industry.
 - A. They are rugged and low maintenance
 - B. They operate only at fixed speed
 - C. They use brushes
 - D. They require frequent maintenance

3. Classify the compressor that operates by reducing gas volume.
 - A. Axial compressor
 - B. Positive displacement compressor
 - C. Centrifugal compressor
 - D. Jet compressor

4. Identify the primary function of a compressor in a plant utility system.
 - A. Increase gas volume
 - B. Reduce gas temperature
 - C. Produce steam
 - D. Increase gas pressure

5. Identify the device that converts electrical energy into mechanical energy.
 - A. Turbine
 - B. Electric motor
 - C. Transformer
 - D. Generator

6. Explain the main function of a condenser in a steam power plant.
 - A. Cool exhaust steam
 - B. Cool exhaust steam
 - C. Compress feedwater
 - D. Generate superheated steam

7. Identify the boiler component used to relieve excess pressure.
 - A. Water level indicator
 - B. Feedwater pump
 - C. Safety valve
 - D. Blowdown valve

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9. Identify the main purpose of a cooling tower in a plant.
 - A. Heat process water
 - B. Purify water
 - C. Remove heat from circulating water
 - D. Increase water pressure

10. Identify the main process involved in secondary wastewater treatment.
 - A. Biological degradation
 - B. Sedimentation
 - C. Screening
 - D. Filtration

11. Identify the primary use of potable water in a plant.
 - A. Cooling tower makeup
 - B. Boiler feedwater
 - C. Process reaction
 - D. Drinking and washing

12. Explain the main function of preliminary wastewater treatment.
 - A. Remove microorganisms
 - B. Remove large suspended solids
 - C. Remove nutrients
 - D. Remove dissolved organic matter

13. Classify the cooling tower that operates without a fan.
- A. Induced draft
 - B. Mechanical draft
 - C. Forced draft
 - D. Natural draft
14. Explain why multistage compression with intercooling is applied.
- A. To increase discharge temperature
 - B. To increase noise
 - C. To reduce compressor efficiency
 - D. To reduce work input
15. Identify the definition that best describes preventive maintenance.
- A. Random maintenance
 - B. Maintenance after failure
 - C. Maintenance at predetermined intervals
 - D. Emergency maintenance
16. Identify the main objective of preventive maintenance for plant utilities.
- A. To increase operating cost
 - B. To repair equipment after failure
 - C. To reduce unplanned breakdowns and extend equipment life
 - D. To delay equipment replacement

17. Explain the benefit of proper lubrication in machinery.
 - A. Reduces wear and friction
 - B. Increases power loss
 - C. Increases vibration
 - D. Increases corrosion

18. Describe what happens to exhaust steam in a condensing steam turbine.
 - A. Reheated in boiler
 - B. Used directly for heating
 - C. Condensed into water
 - D. Released to atmosphere

19. Describe the flow arrangement in a fire tube boiler.
 - A. Heat transfers through plates
 - B. Hot gases flow through tubes surrounded by water
 - C. Steam flows through headers
 - D. Water flows inside tubes

20. Identify the thermodynamic cycle commonly applied in steam power plants.
 - A. Otto cycle
 - B. Carnot cycle
 - C. Diesel cycle
 - D. Rankine cycle

21. Explain the main purpose of bottom blowdown in a boiler.
- A. Increase steam pressure
 - B. Remove dissolved gases
 - C. Remove sludge and sediments
 - D. Control steam temperature
22. Describe the working mechanism of a reciprocating compressor.
- A. Uses rotating impellers
 - B. Uses twin screws
 - C. Uses pistons and cylinders
 - D. Uses vanes in housing
23. Identify the main function of a boiler in a chemical plant.
- A. Store hot water
 - B. Cool process fluids
 - C. Compress air
 - D. Produce steam for process and power generation
24. Classify the boiler type suitable for high-pressure and high-capacity steam generation.
- A. Packaged boiler
 - B. Electric boiler
 - C. Fire tube boiler
 - D. Water tube boiler

25. Explain the cooling principle mainly used in cooling towers.

- A. Radiation
- B. Conduction
- C. Compression
- D. Evaporation

SECTION B (Total: 75 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

Plant utilities and maintenance involve supplying essential support services and performing activities to ensure the plant operates safely and efficiently.

- (a) Show five scopes of plant utilities in an industrial plant.
(5 marks)
- (b) Show four objectives of plant utilities maintenance in an industrial plant.
(4 marks)
- (c) Select three types of water systems used in a plant and their purposes.
(6 marks)
- (d) Select four uses of a nitrogen system in industry.
(4 marks)
- (e) Apply the concept of planned maintenance in a chemical plant with suitable examples.
(3 marks)
- (f) Apply the concept of unplanned maintenance in a chemical plant with suitable examples.
(3 marks)

Question 2

Plant commissioning is an important stage carried out before an industrial plant begins operation. It ensures that plant systems and equipment are ready to operate safely and according to design requirements.

- (a) Apply the key components of plant commissioning during plant commissioning activities.

(3 marks)

- (b) Apply the flushing and cleaning activities of lines and vessels during pre-commissioning.

(4 marks)

- (c) Plant and system commissioning activities require the involvement of designated personnel.

- i. Choose three personnel involved in plant and system commissioning activities.

(3 marks)

- ii. Apply the roles of three personnel involved in plant and system commissioning activities as mentioned in (i).

(6 marks)

- (d) During plant commissioning, several certificates are issued at different stages to verify that equipment, systems, and safety requirements meet design, operational, and regulatory standards.

- i. Apply the role of a Commissioning Certificate in plant commissioning.

(3 marks)

- ii. Apply the role of a Provisional Acceptance Certificate (PAC) during plant commissioning.

(3 marks)

- iii. Apply the role of a Final Acceptance Certificate (FAC) in plant commissioning.

(3 marks)

Question 3

Cooling towers require regular maintenance to preserve high efficiency. Properly structured maintenance schedules for are essential to minimize unplanned downtime and maintain safe operations.

- (a) Using the information below

Checklist A _____

Conduct full mechanical inspection (fans, motors, drive system).
Clean the whole tower system and disinfect entire system.
Check bearing and perform vibration analysis.
Calibrate control and monitoring instruments.
Repaint or repair corroded surfaces.

Checklist B _____

Inspect fan motor condition and gearbox oil levels.
Inspect suction screen for visible algae or biological growth.
Test water sample
Check tower structure
Check vibration, nozzles and spray patterns.

Checklist C _____

Overall visual inspection, use and sequencing
Check cooling tower fan operation and rotation.
Monitor water level in the basin.
Inspect water distribution system for clogging.
Observe for unusual noise or vibration.

Checklist D _____

Check lubrication
Check motor supports and fan blade
Check motor alignment
Check drift eliminator
Clean sump basin and remove sludge

- i. Select the correct maintenance frequency for A, B, C and D

(4 marks)

- ii. Construct a maintenance checklist table based on its maintenance frequency with explanations.

(12 marks)

- (b) Show three main purposes of building maintenance in ensuring safety, maintaining value, and preserving functionality.

(3 marks)

- (c) Select three key factors to consider when selecting a suitable lubricant for industrial equipment

(3 marks)

- (d) Show three purposes of lubrication in maintaining equipment and process systems.

(3 marks)

Question 4

Scheduling of inspection and maintenance is important to keep equipment operating properly. Record keeping and inventory control help maintenance work to be carried out smoothly. These activities are based on basic maintenance principles and maintenance schedules.

- (a) Select four basic principles used in the design of maintenance schedules.
(4 marks)
- (b) Maintenance stores hold all materials, tools, and equipment.
- i. Show five categories of maintenance store components used in an industrial plant.
(5 marks)
- ii. Apply the classification of maintenance store components in (i) with examples for each category.
(5 marks)
- (c) Spare part list is normally provided by the equipment supplier, and further compiled by plant maintenance engineer.
- i. Show four factors considered by a plant maintenance engineer when assessing spare part criticality.
(4 marks)
- ii. Choose two formulas used to determine when and how many spare parts to purchase in a maintenance store.
(2 marks)
- (d) Kedai77 needs 1000 coffee makers per year. The cost of each coffee maker is RM78. Ordering cost is RM100 per order. Carrying cost is 40% of per unit cost. Lead time is 5 days. Kedai77 is open 365 days/yr. Calculate the economic order quantity and re-order point.
(5 marks)

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END OF EXAMINATION PAPER