



**UNIVERSITI KUALA LUMPUR**  
**Malaysian Institute of Marine Engineering Technology**

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**FINAL EXAMINATION**  
**FEBRUARY 2025 SEMESTER SESSION**

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**SUBJECT CODE** : LEB22203

**SUBJECT TITLE** : MARINE INSTRUMENTATION

**PROGRAMME NAME** : DIPLOMA OF ENGINEERING TECHNOLOGY IN  
(FOR MPU: PROGRAMME LEVEL) ELECTRICAL AND ELECTRONICS (MARINE)

**TIME / DURATION** : 09.00AM - 11.30AM  
(2 HOURS 30 MINUTES)

**DATE** : 25 JUNE 2025

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**INSTRUCTIONS TO CANDIDATES**

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1. Please read **CAREFULLY** the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of **TWO (2)** sections; Section A and Section B.
4. Answer **ALL** question in Section A, and **THREE (3)** questions in Section B.
5. Please write your answers on this answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.
7. Formula is appended for your reference.

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**THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.**

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**SECTION A (Total: 40 marks)**

**INSTRUCTION: Answer ALL questions.  
Please use the answer booklet provided.**

**Question 1**

With reference to measurement and instrumentation:

- (a) State THREE (3) main categories of measurement errors. (3 marks)
- (b) Define accuracy and precision. Provide ONE (1) example for each. (4 marks)
- (c) A voltmeter measures 24.3V instead of the true value 24.0V. Determine the absolute and relative error. (5 marks)
- (d) A weighing scale has a resolution of 0.01kg and uncertainty of  $\pm 0.02$ kg. Five measurements are recorded: 10.02, 10.00, 9.98, 10.01, 9.99kg. Determine the mean, standard deviation, and total uncertainty. (8 marks)

**Question 2**

With reference to sensor technology:

- (a) State the primary purpose of a sensor and an actuator. (2 marks)
- (b) List FIVE (5) criteria of a good sensor for marine applications. (5 marks)
- (c) Describe the role of the Integrated Alarm, Monitoring & Control System (IAMCS) contributes to environmental compliance on ships. (5 marks)
- (d) Sketch a labeled block diagram of the IAMCS, including at least FOUR (4) key components. (8 marks)

**SECTION B (Total: 60 marks)**

**INSTRUCTION: Answer THREE (3) questions only.  
Please use the answer booklet provided.**

**Question 3**

With reference to instruments calibration:

- (a) Explain the importance of instrument calibration on board a ship. (8 marks)
- (b) Analyze how cable capacitance and resistivity influence sensor signal accuracy. (6 marks)
- (c) Propose solutions to mitigate signal loss in long sensor cables. (6 marks)

**Question 4**

With reference to Supervisory Control and Data Acquisition (SCADA) systems:

- (a) Describe FOUR (4) key components of a SCADA system and their functions in maritime applications. (8 marks)
- (b) Analyze how SCADA systems improve operational efficiency in shipboard power management. Provide examples from any related real case study. (6 marks)
- (c) Propose a strategy to mitigate cybersecurity risks in maritime SCADA networks. (6 marks)

**Question 5**

With reference to Supervisory Control and Data Acquisition (SCADA) systems:

- (a) Discuss the importance of real-time data acquisition in SCADA for maritime environmental control systems. (6 marks)

- (b) Refer to the following incident:

*"In 2021, an incident occurred involving an LNG carrier, the BW Lesmes, which grounded in the Suez Canal. The BW Lesmes was a 2021-built LNG carrier with a capacity of 174,000 cbm. While transiting southbound through the canal, it ran aground and was later refloated. Additionally, the BW Lesmes was struck by a tanker, the Burri. The incident highlights the potential risks associated with LNG carrier operations, particularly in congested waterways."*

Analyze the role of SCADA in preventing hazardous incidents during LNG cargo operations. (10 marks)

- (c) Explain how communication networks impact the reliability of SCADA systems onboard ships. (4 marks)

**Question 6**

With reference to fire alarm, oxygen and other gases detection systems:

- (a) Describe the structure, key components, advantages and disadvantages of a conventional fire alarm system. (8 marks)

- (b) Compare addressable and hybrid fire detection systems in terms of communication, advantages, and limitations. (6 marks)

- (c) Refer to the following case study:

*"During a fire emergency on a cargo ship, the Emergency Voice Alarm Communication System (EVACS) failed to deliver evacuation instructions".*

Investigate potential causes of this failure and propose corrective measures. (6 marks)

**END OF EXAMINATION PAPER**

## FORMULA SHEET

1	<i>Absolute Error</i> = $ v_A - v_E $
2	<i>Percentage Error</i> = $\left  \frac{v_A - v_E}{v_E} \right  \times 100\%$ where; $v_A$ = approximate (measured) value $v_E$ = exact value
3	<i>Mean</i> $\mu = \frac{\sum_{i=1}^N x_i}{N}$
4	<i>Standard deviation</i> $\sigma = \sqrt{\frac{\sum_{i=1}^N (x_i - \mu)^2}{N - 1}}$
5	<i>Total uncertainty</i> $\mu_{total} = \sqrt{(\sigma)^2 + (\text{instrument uncertainty})^2}$