UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

FEBRUARY 2025 SEMESTER SESSION

SUBJECT CODE	: **LMB31403**
SUBJECT TITLE	: **MARINE AUTOMATION AND CONTROL**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: **BACHELOR OF MARINE ENGINEERING TECHNOLOGY WITH HONOURS**
TIME / DURATION	: **2.00 PM - 4.30PM** **(2 HOURS 30 MINUTES)**
DATE	: **28 JUNE 2025**

INSTRUCTIONS TO CANDIDATES

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 **ONE (1)** section.

4. Answer **FOUR (4)** questions ONLY in this section.

5. Please write your answers on this answer booklet provided.

6. Answer **ALL** questions in English language **ONLY**.

THERE ARE 4 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

(Total: 100 marks)

INSTRUCTION: Answer <u>FOUR (4)</u> questions ONLY.
Please use the answer booklet provided.

Question 1

With reference to the introduction of automation:

(a)   With appropriate examples for each category relevant to a marine engine room system, choose FOUR (4) distinct controller classification categories.

(8 marks)

(b)   Apply the definitions provided for control system signals and variables for a main engine jacket water cooling system:

   i.   The Controlled Variable

(2 marks)

   ii.   The Manipulated Variable

(2 marks)

   iii.   The Set Point

(2 marks)

   iv.   A potential Disturbance

(2 marks)

(c)   Assess THREE (3) importance of having main requirements for any control system in the context of reliable ship machinery operation.

(9 marks)

Question 2

With reference to the control signal and controller actions in a control system:

(a) Sketch the typical system response graph for a Two-Step (On/Off) controller regulating a heating process. Show on the graph the relationship between the measured value, desired value, and the control valve position (Open/Closed) over time.

(8 marks)

(b) Illustrate the concept of 'Offset' inherent in Proportional (P) control action using the boiler drum water level through a simple sketch showing the change in load, desired value, and the resulting steady-state drum level demonstrating offset.

(7 marks)

(c) Relate the objectives of Integral (I) action and Derivative (D) action to improve the performance of a Proportional (P) controller.

(10 marks)

Question 3

With reference to the pressure and level measuring instruments:

(a)   Illustrate THREE (3) differences between absolute pressure (psia) and gauge pressure (psig) using the concept of atmospheric pressure.

(6 marks)

(b)   Construct a simple diagram of a Bourdon tube pressure gauge and demonstrate TWO (2) operations on how pressure applied internally causes the tube to change shape and move an indicator pointer.

(10 marks)

(c)   Sketch a basic sight glass level indicator for a tank and show how it directly indicates the liquid level within the tank.

(9 marks)

Question 4

With reference to final control element (FCE):

(a) Choose THREE (3) main types of actuators and, for each, demonstrate its basic principle of operation in turning or moving a valve.

(9 marks)

(b) Select the appropriate type of valve bonnet for each of the following service conditions, justifying your choice based on the function of the bonnet type:
   i.   Fluid temperature of 150°C

(2 marks)

   ii.   Fluid temperature of -100°C (Cryogenic service)

(2 marks)

   iii.   Handling a highly toxic fluid where zero leakage is essential

(2 marks)

(c) Illustrate TWO (2) primary functions of valve packing within the bonnet assembly.

(4 marks)

(d) Relate the valve flow characteristics termed 'Quick Opening', 'Linear', and 'Equal Percentage (Semi-logarithmic)' to the relationship between valve travel (lift) and the resulting flow rate.

(6 marks)

Question 5

With reference to common control system onboard ships:

(a)   Sketch and label at least SIX (6) components of a fuel oil viscosity control system.

(12 marks)

(b)   Explain TWO (2) operations on how the system maintains optimal viscosity during sudden load changes.

(5 marks)

(c)   Analyze TWO (2) consequences of a blocked steam control valve on engine performance.

(4 marks)

(d)   Propose a modification to include alarms for low fuel temperature.

(4 marks)

END OF QUESTION