UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

FEBRUARY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LMB41202**
SUBJECT TITLE	:	**MARINE ELECTRICAL EQUIPMENT CONTROL SYSTEM**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BACHELOR OF MARINE ENGINEERING TECHNOLOGY WITH HONOURS**
TIME / DURATION	:	**2.00 PM – 5.00PM** **(3 HOURS)**
DATE	:	**21 JUNE 2025**

INSTRUCTIONS TO CANDIDATES

1. Please **CAREFULLY** read 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; Section A.

4. Section A consists of FIVE (5) questions. Answer **FOUR (4)** questions **ONLY**.

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

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

7. Refer the attached Formula.

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 100 marks)

Answer FOUR (4) questions.
Please use the answer booklet provided.

Question 1 (CLO 2)

With reference to automation and control system of the ship.

(a)   Interpret **FOUR (4)** functions of process control.

(4 marks)

(b)   Interpret **THREE (3)** classifications of industrial manufacturing processes.

(3 marks)

(c)   Interpret **THREE (3)** operations of final control element.

(3 marks)

(d)   Interpret **THREE (3)** main tasks to convert the manual feedback control to automatic feedback control.

(3 marks)

(e)   Interpret the main characteristic of dead time in process control.

(2 marks)

(f)   Interpret the working principle of a relay.

(3 marks)

(g)   List **FIVE (5)** components of programmable logic controller (PLC).

(5 marks)

(i)   Interpret the main function of fuse.

(2 marks)

Question 2 (CLO 2)

With reference to automation and control system of the ship.

(a)   Interpret **THREE (3)** types of read only memory.

(3 marks)

(b)   Construct a truth table for the following Boolean expression, $A + BC$.

(2 marks)

(c)   Simplify the Boolean expression, $C + \overline{BC}$.

(2 marks)

(d)   Referring to Figure 1, solve for the output response for a unit step input.
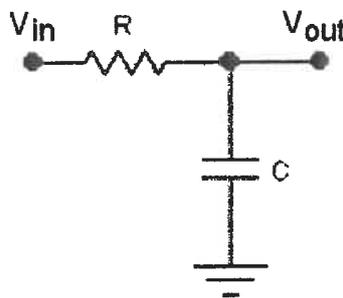
(6 marks)

Figure 1: RC circuit

(e)   Given a system shown in Figure 2, calculate the value of J and D to yield 20% overshoot and a settling time of 2 seconds for a step input of torque.
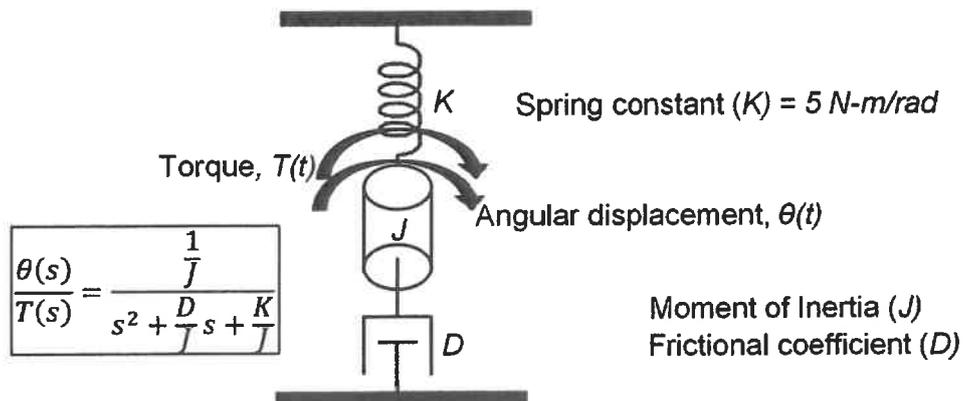
(12 marks)

$$\frac{\theta(s)}{T(s)} = \frac{\frac{1}{J}}{s^2 + \frac{D}{J}s + \frac{K}{J}}$$

Spring constant (K) = 5 N-m/rad

Angular displacement, $\theta(t)$

Moment of Inertia (J)
Frictional coefficient (D)

Figure 2: Rotational system

Question 3 (CLO 2)

With reference to the system configuration of automatic control equipment and safety devices.

(a)   Interpret the operation of oil in water monitoring.

(5 marks)

(b)   Interpret the working principle of flapper and nozzle.

(5 marks)

(c)   Given a differential equation $y'' - 3y' + 2y = e^{3t}$,
        $y(0) = 1, y'(0) = 0$.

        Solve for y(t) using Laplace transform method.

(15 marks)

Question 4 (CLO 2)

With reference to the design features of automatic control equipment and safety devices.

(a)   Interpret the main function of flame retardants.

(2 marks)

(b)   Interpret the working principle of the photoelectric effect.

(4 marks)

(c)   Construct a truth table for the Boolean expression, $\overline{W}(X + Y)Z$.

(9 marks)

(d)   Simplify the Boolean expression, $\overline{A}(A + B) + (B + AA)(A + \overline{B})$.

(10 marks)

Question 5 (CLO 2)

With reference to software version control and Laplace transformation method.
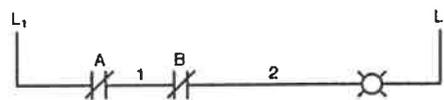
(a)   Identify each of these relay logic functions by name and give their truth table.
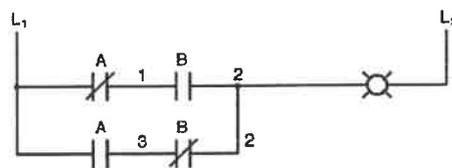
(i)
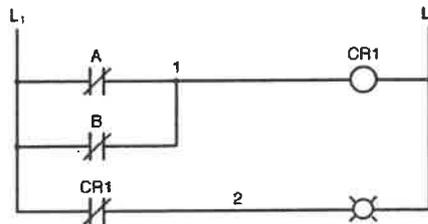
(2 marks)

(ii)

(2 marks)

(iii)

(2 marks)

(b)   Solve the Boolean expression using Karnaugh MAP, construct the truth table and the logic circuit.

(i) $F = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}BC\bar{D} + A\bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D} +$

(5 marks)

(ii) $F = AB\bar{C}\bar{D} + AB\bar{C}D + ABC\bar{D} + ABCD$

(6 marks)

(e)   Solve for a single transfer function for the block diagram shown in Figure 3.
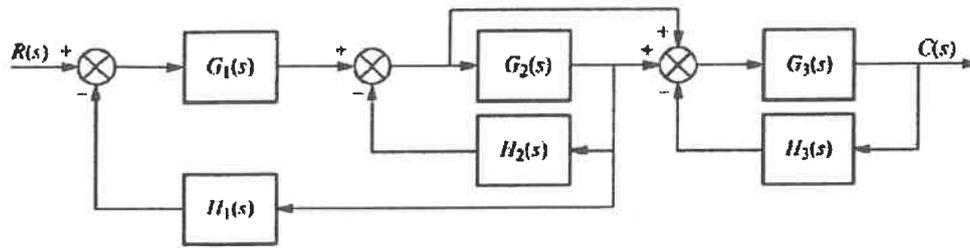
(8 marks)

Figure 3: Block diagram

END OF EXAMINATION PAPER

FORMULA

Partial fraction

$$\frac{1}{s(s+A)} = \frac{a_0}{s+A} + \frac{a_1}{s}$$

$$\frac{1}{s(s+A)(s^2+B)} = \frac{a_0}{s+A} + \frac{a_1}{s} + \frac{a_2 s + a_3}{s^2+B}$$

Inverse Laplace transform

$$L^{-1}\left\{\frac{A}{s}\right\} = A$$

$$L^{-1}\left\{\frac{A}{s^2}\right\} = At$$

$$L^{-1}\left\{\frac{A*n!}{s^{n+1}}\right\} = At^n$$

$$L^{-1}\left\{\frac{1}{s+A}\right\} = e^{-At}$$

$$L^{-1}\left\{\frac{A}{s^2+B^2}\right\} = \frac{A}{B}\sin(Bt)$$

$$L^{-1}\left\{\frac{s}{s^2+B^2}\right\} = \cos(Bt)$$

$$L^{-1}\left\{\frac{B}{(s+A)^2+B^2}\right\} = e^{-At}\sin(Bt)$$

$$L^{-1}\left\{\frac{s+A}{(s+A)^2+B^2}\right\} = e^{-At}\cos(Bt)$$

Laplace transform

$$L\left\{\frac{dy(t)}{dt}\right\} = sY(s) - y(0)$$

$$L\left\{\frac{d^2y(t)}{dt^2}\right\} = s^2 Y(s) - sy(0) - \frac{dy(0)}{dt}$$

$$L\{y'\} = sY(s) - y(0)$$

$$L\{y''\} = s^2 Y(s) - sy(0) - \frac{dy(0)}{dt}$$

[1]	x + 0 = x	[2]	x • 0 = 0
[3]	x + 1 = 1	[4]	x • 1 = x
[5]	x + x = x	[6]	x • x = x
[7]	x + x' = 1	[8]	x • X' = 0
[9]	x + y = y + x	[10]	xy = yx
[11]	x + (y + z) = (x + y) + z	[12]	x(yz) = (xy)z
[13]	x(y + z) = xy +xz	[14]	x + yz = (x + y)(x + z)
[15]	(x + y)' = x'y'	[16]	(xy)' = x' + y'
[17]	(x')' = x		

[15] and [16] : De Morgan's Theorem