CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

FEBRUARY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LED21703**
SUBJECT TITLE	:	**ELECTRONIC COMMUNICATION SYSTEM**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**DIPLOMA OF ENGINEERING TECHNOLOGY IN ELECTRICAL AND ELECTRONICS (MARINE)**
TIME / DURATION	:	**09.00AM – 12.00PM (3 HOURS)**
DATE	:	**24 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 **TWO (2)** Sections; Section A and Section B.
4. Answer **ALL** questions in Section A. For Section B, answer **TWO (2)** questions.
5. Please write your answers on the answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.

THERE ARE 7 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

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

Question 1

With reference to **Introduction to Electronic Communication Systems**:

A shipyard is planning communication systems for a new vessel. Engineers must select suitable systems considering performance, cost, and purpose.

(a) Describe **THREE (3)** basic components of an electronic communication system.

(6 marks)

(b) Distinguish between analogue and digital signals, highlighting their effects on signal quality along with data transmission.

(4 marks)

(c) Differentiate between simplex and full-duplex systems —select the best option for engine room–bridge communication.

(6 marks)

(d) Identify **ONE (1)** advantage and **ONE (1)** disadvantage of using optical fiber rather than coaxial cable for ship-wide data transmission.

(4 marks)

Question 2

With reference to **Antennas and Wave Propagation:**

During a storm, your vessel's communication system experiences reduced performance.

(a) Discuss **TWO (2)** atmospheric effects on wave propagation in marine environments.

(4 marks)

(b) Explain the impact of antenna height and gain on communication reliability in these conditions.

(4 marks)

(c) Differentiate between ground wave, sky wave, and line-of-sight propagation modes.

(6 marks)

(d) Illustrate with a diagram how a ship's antenna radiates EM waves and the relation between electric and magnetic fields.

(6 marks)

Question 3

With reference to **Applications of Communication System**:

During a maintenance drill, the crew is instructed to inspect the onboard fiber optic and satellite communication systems.

(a) Describe **THREE (3)** main components unique to a fiber optic communication system, explaining the function of each.

(6 marks)

(b) Illustrate the difference between single-mode and multi-mode fiber.

(4 marks)

(c) Explain the function of the satellite transponder and its role in communication.

(4 marks)

(d) Discuss **TWO (2)** basic causes of attenuation in optical fiber. Suggest method to reduce it.

(6 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.
Please use the answer booklet provided.

Question 4

With reference to **Spectrum, Noise and Modulation**:

(a) Onboard a ship, data and voice signals are transmitted using different methods. Determine the primary difference between baseband and broadband transmission, highlighting their applications in shipboard communication systems.

(8 marks)

(b) Compare the benefits of Frequency-Division Multiplexing (FDM) and Time-Division Multiplexing (TDM) in digital communication systems. (4 marks)

(4 marks)

(c) A UHF signal with an initial power of 2 mW is passed through an amplifier with a gain of 15 dB. Calculate the output power in milliwatts.

(4 marks)

(d) A signal with an initial power of 10 W passes through a system that attenuates the signal by 5 dB. Calculate the final output power.

(4 marks)

Question 5

With reference to **Spectrum, Noise and Modulation**:

During emergency communication using AM, the signal has a carrier of 800 kHz, modulating frequency of 5 kHz, and peak modulating voltage of 6 V. The carrier amplitude is 10 V, and the load is 50 Ω.

(a) Differentiate under-modulation and over-modulation based on envelope values, with relevant diagrams.

$P_{USB} = P_{LSB} = \frac{A_c^2 m_a^2}{8R}$

(6 marks)

(b) Calculate the modulation index and sideband power. Upper sideband $= f_c + f_m$

(6 marks)

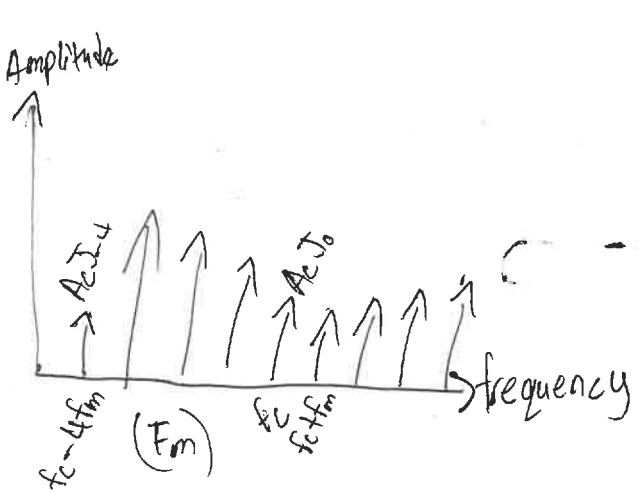
(c) Determine the total power of the AM wave. $P_T = P_c\left(1 + \frac{m_a^2}{2}\right)$

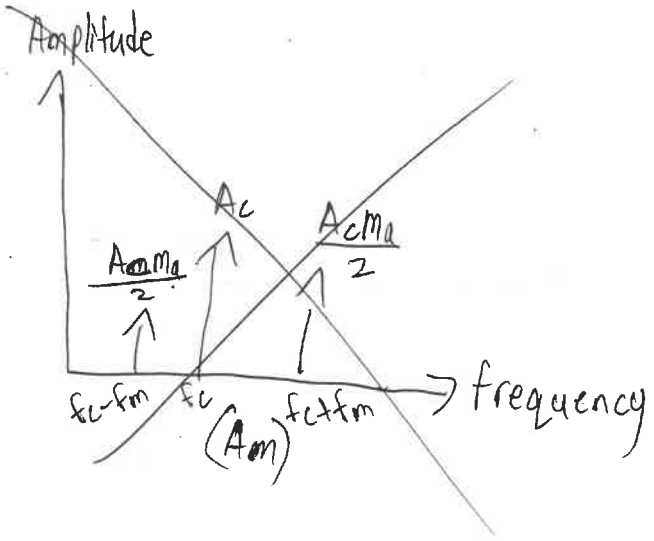
$P_C = \frac{A_c^2}{2R}$

(4 marks)

(d) Illustrate the AM spectrum with carrier and sidebands, labeling frequencies and voltage amplitudes.

(4 marks)





Question 6

With reference to **Spectrum, Noise and Modulation**:

A satellite sends video using FM with a carrier of 900 MHz, a modulating frequency of 25 kHz, and a frequency deviation of 37.5 kHz. The amplitude of the carrier is 5 V.

(a) Identify **TWO (2)** advantages of using FM over AM for this transmission.

(4 marks)

(b) Calculate the modulation index and number of significant sideband frequency pairs.

(4 marks)

(c) Determine the carrier swing and the required bandwidth.

(4 marks)

(d) Illustrate the FM spectrum using a Bessel function table, showing all significant frequency components and amplitudes.

(8 marks)

Table 1: Bessel Function Table

Modulating Index	Carrier	Sideband Frequency Pair (n)						
m	J_0	J_1	J_2	J_3	J_4	J_5	J_6	J_7
0.00	1.00	-	-	-	-	-	-	-
0.25	0.98	0.12	-	-	-	-	-	-
0.50	0.94	0.24	0.03	-	-	-	-	-
1.00	0.77	0.44	0.11	0.02	-	-	-	-
1.50	0.51	0.56	0.23	0.06	0.01	-	-	-
2.00	0.22	0.58	0.35	0.13	0.03	-	-	-
2.50	-0.05	0.50	0.45	0.22	0.07	0.02	-	-
3.00	-0.26	0.34	0.49	0.31	0.13	0.04	0.01	-

END OF EXAMINATION PAPER

$m_a = \frac{A_m}{A_c}$

$m_f = \frac{\Delta f}{f_m}$

Upper sideband = $A_c + A_m$

lower sideband = $A_c - A_m$

$BW = f_{max} - f_{min}$

Sideband power =

$P_T =$

$BW = 2f$

$BW = f_{max} - f_{min}$

$= 2f_m$

Lower sideband $= f_c - f_m$