UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
MARCH 2025 SEMESTER SESSION

SUBJECT CODE	:	**LEB40703**
SUBJECT TITLE	:	**UNDERWATER ACOUSTICS SYSTEMS**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BACHELOR OF ELECTRICAL AND ELECTRONICS ENGINEERING TECHNOLOGY (MARINE) WITH HONOURS**
TIME / DURATION	:	**2.00 PM - 5.00 PM (3 HOURS)**
DATE	:	**23 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 **FOUR (4)** questions ONLY.
4. Please write your answers on this answer booklet provided.
5. Answer **ALL** questions in English language **ONLY**.
6. Answer should be written in blue or black ink except for sketching, graphic and illustration.

THERE ARE 3 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

Total marks: 100

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

Question 1

(a) Explain the function of acoustic transducers in underwater sonar systems and their role in detecting objects and measuring distances underwater.

(10 marks)

(b) Discuss the principles of sound propagation in underwater acoustics. In your answer, include the factors that influence the speed of sound in water and the basic characteristics of acoustic waves.

(15 marks)

Question 2

(a) Explain the different types of noise in underwater acoustics and their impact on sonar systems.

(10 marks)

(b) Explain sonar resolution and signal duration, including the differences between Pulsed Sonar and CHIRP Sonar.

(15 marks)

Question 3

(a) Explain the operation of hydrophones in sonar systems, including their function, types, and the importance of beam forming and signal processing.

(10 marks)

(b) Explain the role of beam forming and signal processing in hydrophone operation and their impact on enhancing sonar system performance.

(15 marks)

Question 4

(a) Explain the concept of discrete arrays in sonar systems and the importance of element spacing.

(10 marks)

(b) Discuss the effect of element spacing on directivity and resolution and the roles of beamforming and beam steering techniques in enhancing sonar system performance.

(15 marks)

Question 5

(a) Explain the concept of reverberation in underwater acoustics and the different sources of reverberation, including surface and bottom.

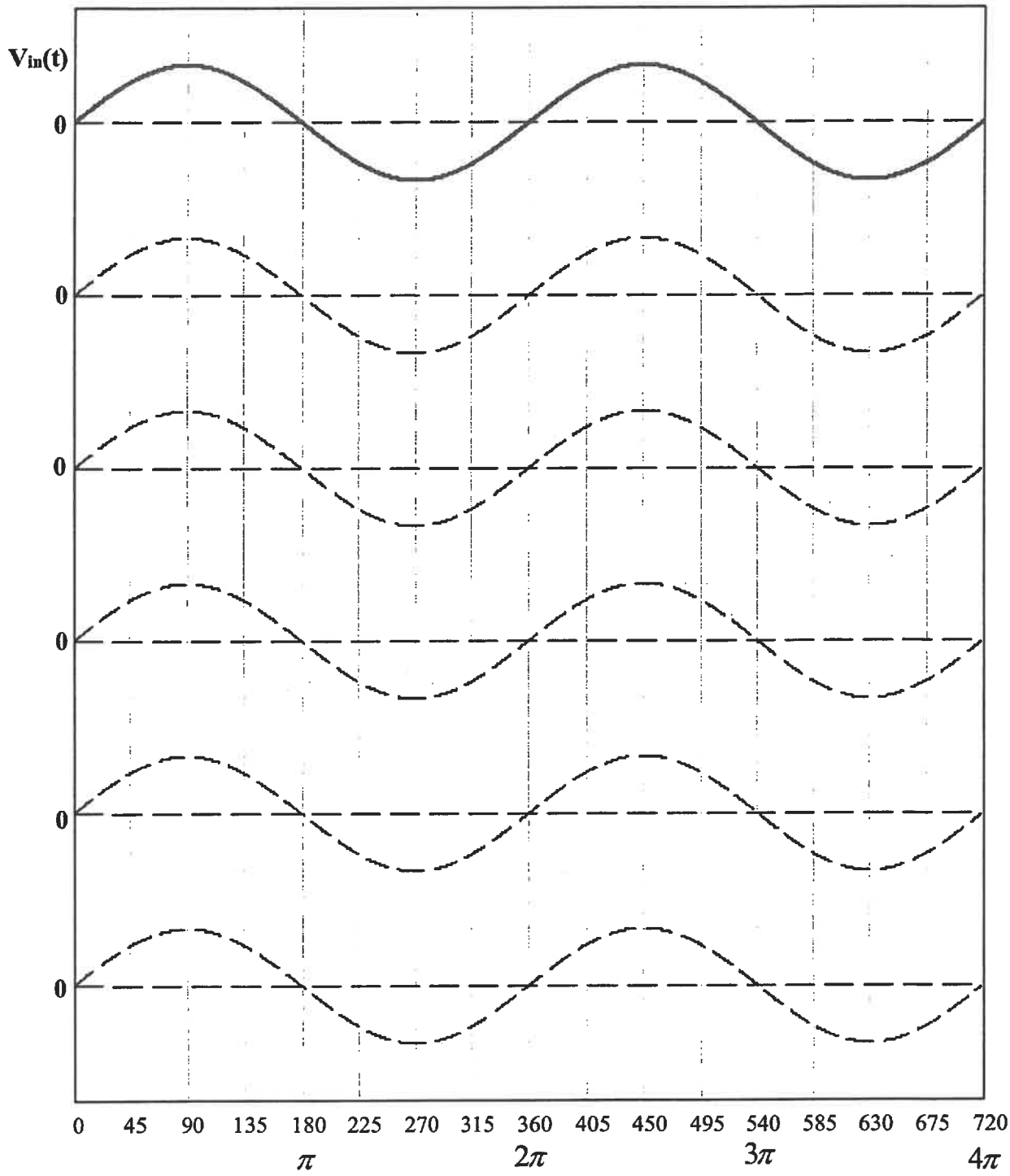
(10 marks)

(b) Discuss the working principles of hydrophones made of PVDF and PZT ceramics and include their applications in underwater acoustics.

(15 marks)

END OF EXAMINATION PAPER

APPENDIX I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