

**UNIVERSITI KUALA LUMPUR**  
**MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY**

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**FINAL EXAMINATION**  
**JANUARY 2016 SEMESTER**

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**COURSE CODE** : LEB 20803

**COURSE NAME** : NAVIGATION EQUIPMENT AND SYSTEM

**PROGRAMME NAME** : BACHELOR OF MARINE ELECTRICAL ELECTRONICS  
(FOR MPU: PROGRAMME LEVEL) TECHNOLOGY

**DATE** :

**TIME** :

**DURATION** : 2 HOURS 30 MINUTES

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**INSTRUCTIONS TO CANDIDATES**

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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 5 questions.
4. Answer FOUR questions only.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English language ONLY.

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THERE ARE 6 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

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

**Question 1**

- (a) Draw and label the basic block diagram of a radar system. (6 marks)
- (b) Draw and label the Gyro Compass system block diagram (8 marks)
- (c) Illustrate the segments of a GPS with a diagram and show the relationship of all the segments. (5 marks)
- (d) Draw and label the block diagram of an Echo Sounder system. (6 marks)

**Question 2**

- (a) Calculate the directional gain in decibels [ $G_{dir}$  (dB)] where the vertical beamwidth of a long range radar system is  $30^\circ$  and the horizontal beamwidth is  $20^\circ$  (9 marks)
- (b) Calculate the received power from the following data. (5 marks)
- Range = 56 km  
Transmitted power = 5.64 kW  
Gain = 5488  
Effective aperture =  $25.1 \text{ m}^2$   
Target cross-section =  $1 \text{ m}^2$

(c) State the meaning of SPL

(1 mark)

(d) i. The wave before doubling its intensity (i.e. power) is given as:

$$SPL_1 = 20 \text{ Log}(p_1/1 \mu\text{Pa})$$

Prove that the wave after doubling its intensity is

$$SPL_2 = SPL_1 + 3$$

ii. By using the Brute force method calculate the final  $SPL_f$  where  $SPL_1 = 72 \text{ dB}$  and  $SPL_2 = 75 \text{ dB}$

(10 marks)

### Question 3

(a) Elaborate the difference between a gyro compass and a magnetic compass

(4 marks)

(b) Refer to Figure 1. Determine

i. XX

ii. YY

iii. ZZ

iv. A

v. B

(5 marks)

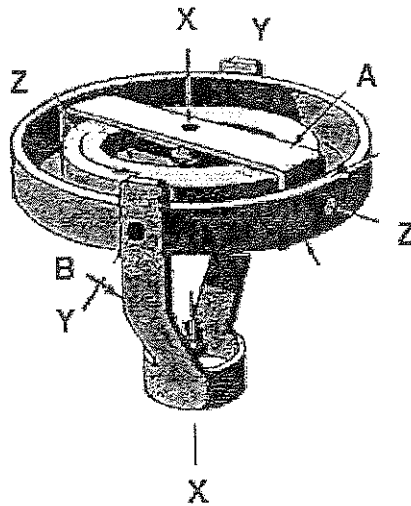


Figure 1

- (c) If the time delay is  $D_t$  and  $c$  is the speed of light, write down the simple formula for radar slant range.

Calculate the slant range of an aircraft if the reflected echo reached the receiver  $7.6\mu\text{s}$  after transmission.

(5 marks)

- (d) Define duty cycle of radar.

(3 marks)

- (e) Explain clearly the importance (including function) of these components in the radar system.

- i. Transmitter
- ii. Duplexer

(8 marks)

#### Question 4

- (a) One of the agencies that managed the DGPS is the US Coast Guard (USCG). Describe the additional equipment that can be found on this system compare with the GPS system (Hint – at the control segment or ground station).

(4 marks)

(b) Among the receiver outputs appear at the GPS are position, velocity and time. Specify any FOUR (4) output parameters under these categories.

(4 marks)

(c) The table below shows the usage of various frequency bands for GPS. Describe the usage of frequency for (a), (b) and (c).

Band	Frequency	Usage
L1	1575.42 MHz	Coarse-acquisition (C/A) and encrypted precision P(Y) codes, plus the L1 civilian (L1C) and military (M) codes on future Block III satellites.
L2	1227.60 MHz	(a)
L3	1381.05 MHz	(b)
L4	1379.913 MHz	Being studied for additional ionosphere correction.
L5	1176.45 MHz	(c)

(6 marks)

(d) Explain how to calculate the user position (own ship) in the GPS.

(5 marks)

(e) Placing a satellite into geosynchronous orbit requires an enormous amount of energy. Explain clearly the TWO (2) phases of the launching process.

(6 marks)

**Question 5**

(a) State the function of transducer.

(2 marks)

(b) Name any TWO (2) types of transducers that you know.

(2 marks)

- (c) There are two types of transmission of acoustic energy for depth sounding. Explain ONE (1) of the types.  
(5 marks)
- (d) Absorption is one of the considerations of the underwater sound. List FOUR (4) other consideration of the underwater sound.  
(4 marks)
- (e) Draw the block diagram of a passive sonar system.  
(6 marks)
- (f) Explain briefly the following components of the passive sonar.
- i. Hydrophone array
  - ii. Beamforming processor
- (6 marks)

END OF EXAMINATION PAPER

