



**FIJI NATIONAL UNIVERSITY**

**College of Engineering, Science & Technology**

**SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING**  
**TRADE DIPLOMA IN ELECTRONIC ENGINEERING**

**EEE563 – RADAR & MICROWAVE.**

**FINAL EXAMINATION – TRIMESTER 2 - 2017.**

**TIME: TBA**

**DURATION: 3 HOURS**

**Date: TBA**

**Total No. of Pages: 4**

**INSTRUCTIONS TO STUDENTS:**

1. You are allowed 10 minutes **EXTRA** as reading time during which you are **NOT** to write.
  2. Begin each answer on a fresh page and use both sides of the sheet.
  3. Write your candidate number at the top of each attached sheet.
  4. Insert all written foolscap, graph paper, drawing paper, etc. in their correct sequence and secure well.
  5. For all sheets of paper on which rough/draft work has been done, cross it through and attach to your answer scripts.
  6. Show all workings where necessary
  7. Diagrams and graphs can be drawn in pencil.
  8. Non- programmable calculators are allowed.
  9. **ATTEMPT ALL QUESTIONS**
  10. **Check your work before you leave the room!!**
-

**Section A**

**(20 marks)**

**Question 1**

- a) Radar is an acronym for? **(1 mark)**
- b) Which frequency band does radar operate on? **(2 marks)**
- c) What properties of radar frequencies make it suitable for detection? **(3 marks)**
- d) Draw and label a radar beam diagram? **(4 marks)**

**Question 2**

- a) With the aid of a diagram explain Pulse Radar? **(10 marks)**

**Section B**

**(20 Marks)**

**Question 1**

- a) Draw a block diagram of Continuous Radar and explain how it is different from pulse Radar? **(5 marks)**
- b) Explain how the Doppler Effect works? **(5 marks)**

**Question 2**

A radar boat is watching a ferry boat coming towards it. The speed of the ferry boat is 5.50m/s. the ferry boat sounds its horn, producing a note of frequency 95Hz. The speed of sound over air is  $3.50 \times 10^3$  m/s.

- a) Calculate the frequency of the note that the radar boat detects **(3 marks)**
- b) A fixed source emits sound of frequency 1000 Hz. What is the frequency as heard by an observer
  - (i) at rest **(1 mark)**
  - (ii) Moving towards the source at a constant speed of 20 ms<sup>-1</sup> **(3 marks)**
  - (iii) Moving away from the source at the same rate. **(3 marks)**

### Section C

(20 marks)

#### Question 1

- If a RADAR has a pulse width of 20 microseconds and a recovery time of 1 microsecond, what is the minimum range. Comment on your answer? **(4 marks)**
- Name 3 factors that affect the minimum range? **(3 marks)**
- What is the maximum unambiguous range for radar with a PRF of 490 Hz? What PRF is required for maximum unambiguous range of 376 km? **(4 marks)**

#### Question 2

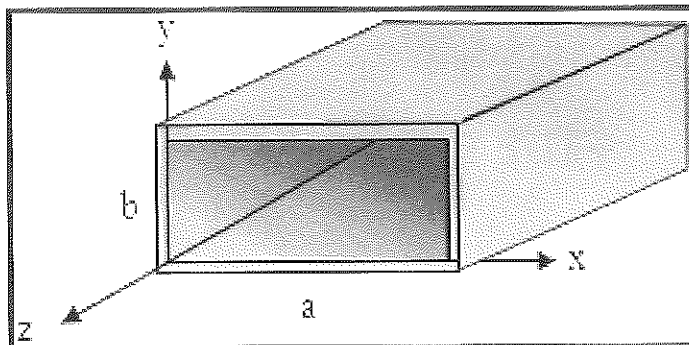
- Explain what antenna directivity is? **(2 marks)**
- Explain what antenna reciprocity is? **(2 marks)**
- An antenna transmitting waveform has a peak voltage of 20V and reflected voltage of 10V. What is the standing wave ratio? Comment on your answer? **(3 marks)**
- What does a VSWR of 1:1 mean? **(2 marks)**

### Section D

(20 marks)

#### Question 1

- What is the application of waveguide in transmission? **(1 mark)**
- Name the 4 modes of transmission using a waveguide **(2 marks)**
- Explain the dimensions of the waveguide below which determines the operating frequency range **(2.5 marks)**



- For the dominant mode propagated in an air filled circular waveguide, the cut-off wavelength is 10 cm. Find;  
(i) the required size or cross sectional area of the guide **(2.5 marks)**  
(ii) the frequencies that can be used for this mode of propagation **(2 marks)**

**Question 2**

The dimensions of the waveguide are 2.5 cm · 1 cm. The frequency is 8.6 GHz.

Find;

- (i) possible modes **(4 marks)**
- (ii) cut – off frequency for TE waves. **(6 marks)**

**Section E**

**(20 marks)**

**Question 1**

- a) Explain the function of a microwave tube? **(2 marks)**
- b) Why is a microwave tube preferred over semiconductor devices in generating frequency? **(2 marks)**
- c) Name the 2 types of microwave tubes? **(2 marks)**
- d) Draw the klystron cross-section diagram **(4 marks)**

**Question 2**

- a) Name 3 differences between Klystron and Reflex Klystron tubes? **(3 marks)**
- b) Which type of tube is commonly used in radar applications? **(2 marks)**
- c) What is a microwave or semiconductor device? **(2 marks)**
- d) Name 3 types of semiconductor devices? **(3 marks)**

-----THE END-----