REPUBLIC OF RWANDA

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**OPTION: ELECTRONICS AND TELECOMUNICATION/ETT**

**YEAR 3/EVENING PROGRAM**

**RADAR TECHNOLOGY AND NAVIGATION AIDS**

**Assignment 2**

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**QUESTION ONE / 10MARKS**

1. Find the power density at a target situated at a distance of 75 km from radar radiating a power of 100 MW from a lossless isotropic antenna. **2marks**
2. If this radar now employs a lossless isotropic antenna with a gain of 7000 and the target has a radar cross-section of 2.4 m2, then what is the power density of the echo signal at the receiver? **/2marks**
3. If the minimum detectable signal of the radar is 10*−*8 MW and the wavelength of the transmitted energy is 0.04 m, then what is the maximum range at which the radar can detect targets of the kind mentioned in (b)? And what is the effective area of the receiving antenna? **/2marks**

**A,B AND C ANSWERS ON THE HAND WRITING PAPER**

1. Differentiate the following terms in navigation system LORAN A, LORAN C, DECCA AND OMEGA SYSTEM **/2marks**

**Answer:**

 **LORAN A**: An early long-range navigation system that uses low-frequency radio transmitters to provide hyperbolic lines of position, primarily for maritime navigation.

 **LORAN C**: A more advanced version of LORAN A, offering greater accuracy and longer range by using a different frequency and improved technology, widely used for maritime and aviation navigation.

 **DECCA**: A navigation system using low-frequency radio signals to determine position by measuring the phase difference between signals from a chain of fixed transmitters, commonly used in coastal areas.

 **OMEGA System**: A global navigation system that uses very low-frequency radio signals from a network of transmitters around the world to provide long-range positioning, primarily for maritime and aviation use.

1. State at least 4 methods of navigations **/2marks**

**Answer:**

* Navigation by pilotage
* Celestial navigation
* Dead reckoning
* Radio Navigation

**QUESTION TWO / 10 MARKS**

1. State at least 5 radar observables while tracking the target.

**Answer**

* Size of the target
* Altitude of the target
* Elevation angle of the target
* Speed of the target
* Build Material of the target

1. What is the frequency range of radar?

**Answer:**

Radar systems primarily use microwaves, and according to Wikipedia , microwaves fall within the frequency range of approximately **300 MHz and 300 GHz**

1. State 4 advantages of radar system/**2marks**

**Answer**

1. All-weather capability

2. Long-range detection

3. High accuracy in measuring distance and speed

4. Real-time tracking and imaging

1. What are the names of small radio transmitters that a signal distances from touchdown? Explain their roles/**2marks**

**Answer:**

They're called "radio altimeters" or "radar altimeters" and are crucial during aircraft landing. These devices measure the distance from the aircraft to the ground, providing pilots with real-time altitude data, especially during critical landing phases, ensuring safe touchdowns.

1. Write in full the following abbreviation**: RADAR, MTI,** /**2marks**

**Answer**

**Answer:**

**RADAR**: Radio Detection and Ranging

**MTI**: Moving Target Indication

**QUESTION THREE / 10MARKS**

1. Draw a block diagram of a basic radar and improved radar. /**6marks**

**ANSWER ON THE HAND WRITING PAPER**

1. The following figure is the one of navigation techniques between Homing and Tracking, Which one among these two? Differentiates them. /**4marks**

**Answer**

It is **Homing.**

Homing involves a moving object directing itself towards a target, adjusting its course based on target signals. Tracking, on the other hand, is about monitoring an object's position over time without necessarily moving towards it, often using external sensors.