jhbkREPUBLIC 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 Nauvg9ypu;h.vigation

guj

**QUESTION TWO vuivhj / 10 MARKS**

1. State at least 5 rada zcxzxjbr observables while tracking the target.

**Answer**

* Size of the target
* Altitude of the target
* FDSJO HFODNCAUFBWU0[OElevation angle of sfdbvbmsdfthe target
* Speed of therewvh target
* Build Material of the target

1. What is the frequency range of radar?fdhjdsj

**Answer:**

Radar sgvjbjjjysvbiytrewtems ghv;k.jvhlb 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 ranmmnmnlkljlhiguftuuuouu9trtewdio transmitters that a signal distk hjb miyl yiancbir f67d bijhes from touchdown? Explain their roles/**2marks**

**Ajhjjjf f8f6 8t86u bnb uy j k f7tnswer:**

They're callev 7divgv t byfhjbjhv y vg 7tyyunv i7fi utufjiyvlvhjb hj ykgd "radio altimeters hilk vm" or "radar altimeters" and are crucial during aircraft landing. These devices m u y gu79h p9ul uv yg8 iu urd7 easure the distance from the aircraft to t gut ft jb8 uvy 8ybiu okhe ground, providing pilots with real-time altitude data, especially during critical landing phases, ensuring sbb kh afbbh ki gy nm ju h v8g vjhvjge touchdowns.

1. Write in full uv 7iuyhgujct7reiygntihvhmjguvtt the following abbreviation**: RADAR, MTI,** /**2marks**

**Answer ihuhhvhvg gv t7 cgf7hoouop**

**Answer:**

**RADAR**: Radio Detection and Ranging

**MTI**: Moving Target Indication

**QUESTION THhREE / 10MARKS**

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

**gugjg**

**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**

**U cy**

**U8uuy t7 uy7t7 g7ttAnbvvghyxswer**

It is **Hycyuouyhjmkghbhjhbjoming.**

Homing involves a moving object directing itself towards a target, adjuhhgsting its course based on targn v tt 7iet signals. Tracking, on the other hand, is about monitoring an object's position over time without necessarily moving towards it, often using external sensors.