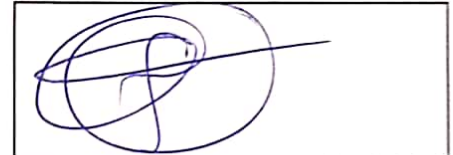**ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE**
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND COMPUTER
ENGINEERING

FIRST SEMESTER EXAMINATION, 2019/2020 ACADEMIC SESSION
COURSE TITLE: ANTENNA AND PROPAGATION

COURSE CODE: EEE 413

EXAMINATION DATE: 7th of April, 2021

COURSE LECTURER: Dr Adedeji K. and Mr Olla M. O.   HOD's SIGNATURE

TIME ALLOWED: **3 HOURS**

INSTRUCTIONS:
1. ANSWER ~~QUESTION ONE AND ANY OTHER FOUR~~ five QUESTIONS
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE **NOT** ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION.

Question 1 (15 marks)

(a) State the integral form of Maxwell's equations as applied for both static and dynamic cases of electromagnetic phenomenon. Details of the parameter functions of the equations should be well defined.

(b) Communication links between two stations is separated by a distance "R" as shown in figure 1, show that the received power of the antenna is:

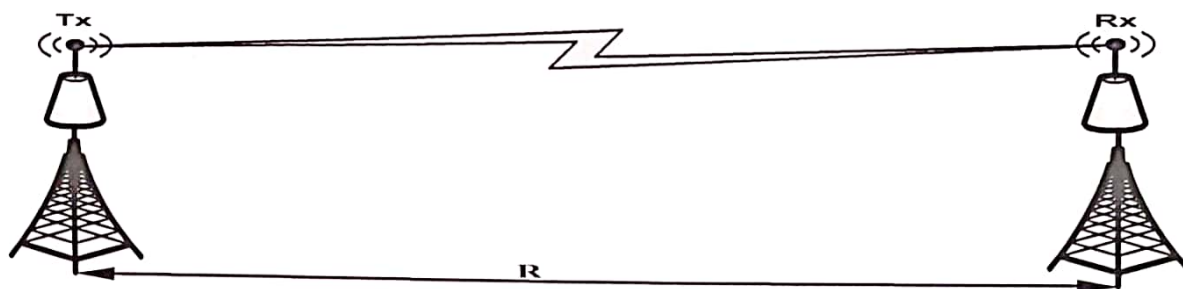$$P_r = P_t G_t G_r \left(\frac{\lambda}{4\pi R}\right)^2$$

Figure 1.

Question 2 (15 marks)

(a) Explain what is antenna and its main functions
(b) Explain the radiation principle of a dipole antenna
(c) In satellite communication system, the height of the satellite is 3600 km above earth and operated at frequency of 4000 MHz. The gain of the receiving antenna is 40 dB. Find (i) the free space loss (ii) the power received when transmitted power is 200 W

Question 3 (15 marks)

(a) Write short note on the following (i) Radiation Pattern (ii) Half Power Beamwidth (HPBW) (iii) First Null Beamwidth (FNBW) (iv) Field Pattern (v) Power Pattern
(b) With the use of mathematical expression, show that the reflection coefficient (γ) of the transmission line shown in figure 1 is equal to 1


Figure 1

2

Question 4 (15 marks)

(i) Discuss with the aid of a well-labelled diagram, the principle of operation of a pulsed radar system.

(ii) A certain airborne pulse radar has a peak power $P_t=10$kW and uses two PRFs with $f_{r1}=10$ kHz and $f_{r2}=20$kHz. What is the required pulse width for each PRF so that the average transmitted power is constant and equal to 1000W? Compute the pulse energy in each case.

Question 5 (15 marks)

(i) Sketch the earth atmospheric structure and indicate where the radio wave propagation mode occurs.

(ii) A certain C-band radar with the following parameters; peak power $P_t=1.5$MW, operating frequency of 5.6GHz, antenna gain of 45dB, effective temperature of 290K and pulse width τ of 0.2 micro secs. The radar threshold SNR_{min} is 20dB. Assume a target cross-section of $0.1m^2$ and a figure of merit of 3dB for the radar receiver. Compute the maximum range.

Question 6 (15 marks)

(i) Briefly explain sky wave propagation

(ii) The pulsed radar shown in Fig X. operates at a frequency of 5.6 GHz. Compute the Doppler frequency measures by the radar.
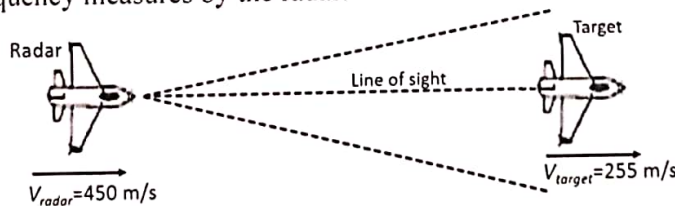
Question 7 (15 marks)

(a) What do you understand by the following terms used in sky wave propagation?
   (i) Maximum usable frequency, (ii) Critical frequency, (iii) Skip distance

(b) With the aid of diagram, explain the following antenna pattern:
   (i) Omnidirectional antenna (ii) Isotropic antenna (iii) Directional antenna