ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

SEMESTER I EXAMINATION, 2016/2017 ACADEMIC SESSION

COURSE TITLE: ANTENNAS AND PROPAGATION

COURSE CODE: EEE 413

EXAMINATION DATE: APRIL, 2017

COURSE LECTURER: DR. O. ADETAN

HOD's SIGNATURE

TIME ALLOWED: $2\frac{1}{2}$ HRS

INSTRUCTIONS:

1. ANSWER FOUR (4) QUESTIONS IN ALL. QUESTION No.1 IS COMPULSORY
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE **NOT** ALLOWED TO BORROW CALCULATORS AND ANY OTHER WRITING MATERIALS DURING THE EXAMINATION.
4. YOU ARE PROVIDED WITH SMITH CHARTS. KINDLY ENSURE TO USE PENCIL ONLY ON THE CHART.

QUESTION 1 [25 marks]

(a) Write short notes on the followings:

i. Polarization
ii. Antenna efficiency
iii. Return ratio
iv. Input impedance
v. Waveguides [5 marks]

(b) The measured input impedance of a 10 m length of 300 Ω transmission line is given as $Z_L = 120 - j650\ \Omega$.. The velocity factor is 0.9 and the frequency is 50 MHz. Using the Smith chart, (i) plot the load impedance, (ii) draw the VSWR and (iii) find the reflection coefficient [3 marks]

(c) If the input impedance in (b) above is replaced with four (4) loads represented as: $Z_{LA} = 100 - j100\ \Omega$, $Z_{LB} = 50 + j100\ \Omega$, $Z_{LC} = 300 - j25\ \Omega$ and $Z_{LD} = 50\ \Omega$;

Find the load impedance, VSWR and the reflection coefficient, given that the characteristics impedance is 50 Ω. [10 marks]

(d) Using a suitable block diagram of basic radar, describe briefly the functions of the various components of the radar system [3 marks].

(e) Mention four (4) characteristics of a radar target [2 marks]

(f) State the Maxwell equations in differential and integral forms [2 marks]

QUESTION 2 [15 marks]

(a) What is an Antenna? [3 marks]

(b) On what basis can you classify antennas? Give two (2) examples in each case [8 marks]

(c) Mention and explain four (4) types of antenna in the 2.4 GHz frequency known to you [4 marks]

QUESTION 3 [15 marks]

(a) The effective aperture of a transmitting antenna determines the amount of power that the receiving antenna extracts from the RF power density. Show that the gain of the transmitting antenna with respect to the effective aperture is given by:

$$P_R = \frac{P_T G_T G_R \lambda^2}{16\pi^2 r^2}$$

Define each parameter as given in the expression. What if the transmitting power is intercepted by scattering obstacle at a range *R*, show that the scattered power received by the receiver with an aperture *A* behaves like mono static radar [10 marks].

(b) If the transmitter radiating output power from an isotropic antenna is 30 W and the received power is 75 W. Calculate the transmission loss between transmit and receive antennas [5 marks]

QUESTION 4

(a) The form of electromagnetic signal radiated by radar depends upon the type of information needed about the target. Describe the principles behind the operation of radar [4 marks].

(b) Mention and explain six (6) characteristics of radar [6 marks] (bii) State the relationship between the transmitter power, antenna gains and received signal to noise in a free space radio link [5 marks]

QUESTION 5 [15 marks]

(a) Using the block diagram of basic pulse modulated radar, discuss the functions of the various components of the radar system [8 marks]

(b) What do you understand by radar horizon? Mention and explain five (5) weather factors that can affect the radar horizon [7 marks]

QUESTION 6 [15 marks]

(a) Discuss the Electromagnetic waves spectrum in their order of increasing or decreasing frequency and wavelength. Identify the practical applications of each spectrum in Science and Engineering Fields [10 marks]

(b) What do you understand by transmission line? [2 marks]. Mention three (3) examples [3 marks].