**The University of New Mexico**

**School of Engineering**

**Electrical and Computer Engineering Department**

**ECE 535 Satellite Communications**

**Student Name: Alex Hostick**

Student SN: 2O1

Module # 6: 5.3, 5.5, 5.7, 5.9, 5.13, 5.14, 5.17, 5.21, 5.24, 5.25, 5.26, 5.27

Fall 2023

**Prof. Tarief Elshafiey**

**5.3 Two electric fields with an amplitude ratio of 3:1 and in time phase, act at right angles to one another in space. On a set of x-y axes draw the path traced by the tip of the resultant. Given that the total power developed across a 50 Ω load is 10 W, find the peak voltage corresponding to the unity amplitude.**

P = 10W, Ω = 50, ratio 3:1

Find peak voltage at unity amplitude:

Per Ohm’s law and average RMS power in a sinusoidal wave…

A diagram of a cross with arrows

Description automatically generated

**5.5 Two electric field vectors of amplitude ratio 3:1, are 90° out of time phase with one another. On a set of x-y axes draw the path traced by the tip of the resultant vector. If the peak voltages are 3 V and 1 V determine the average power developed in a 10 Ω load.**

;

**A diagram of a mathematical equation

Description automatically generated**

**5.7 With δ = -45° and equal amplitude components, determine the sense of polarization of a wave represented by Eq. (5.6).**

Plot ωt from 0 to

LH Elliptical Polarization

**5.9 A plane TEM wave has a horizontal (+*x* directed) component of electric field of amplitude 3 V/m and a vertical (+*y* directed) component of electric field of amplitude 5 V/m. The horizontal component lags the vertical component by a phase angle of 20°. Determine the sense of polarization.**

Plot ωt from 0 to

LH Elliptical Polarization

**5.13 A plane TEM wave has a horizontal (+*x*-directed) component of electric field of amplitude 3 V/m and a vertical (+*y*-directed) component of electric field of amplitude 5 V/m. The components are in time phase with one another. Determine the angle a linearly polarized antenna must be at with reference to the *x* axis to receive maximum signal.**

**(a) At 0.01 percent:**

**5.14 For Prob. 5.13, what would be the reduction in decibels of the received signal if the antenna is placed along the x axis?**

**(a) At 0.01 percent:**

Reduction of decibels =

**5.17 A geostationary satellite stationed at 90°W transmits a vertically polarized wave. Determine the polarization of the resulting signal received at an earth station situated at 70°W, 45°N.**

r = -R = - k = e =

f =

g =

h =

p \* f =

**5.21 A linearly polarized wave traveling through the ionosphere suffers a Faraday rotation of 9°. Calculate (a) the polarization loss and (b) the cross polarization discrimination.**

(a) Polarization Loss

(b) Cross Polarization Discrimination

**5.24 A transmission path between an earth station and a satellite has an angle of elevation of 32° with reference to the earth. The transmission is circularly polarized at a frequency of 12 GHz. Given that rain attenuation on the path is 1 dB, calculate the cross-polarization discrimination.**

**5.25 Repeat Prob. 5.24 for a linearly polarized signal where the electric field vector is parallel to the earth at the earth station.**

**5.26 Repeat Prob. 5.24 for a linearly polarized signal where the electric field vector lies in the plane containing the direction of propagation and the local vertical at the earth station.**

**5.27 Repeat Prob. 5.24 for a signal frequency of 18 GHz and an attenuation of 1.5 dB.**