**The University of New Mexico**

**School of Engineering**

**Electrical and Computer Engineering Department**

**ECE 535 Satellite Communications**

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

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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.

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.

5.7. With and equal amplitude components, determine the sense of polarization of a wave represented by Eq. (5.6).

This would make it left-hand elliptical polarization because the x-component is lagging the y-component by that delta with equal amplitude.

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.

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.

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?

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.

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