

# E2 203 Wireless Communications (Jan.-Apr. 2011)

## Problem Set 1

Rajesh Sundaresan and Neelesh B. Mehta  
 Due: February 18, 2011, 4:00 PM

**Remarks:**

- You may collaborate, discuss, work in teams to solve problems.
- Each student must write the solution in his/her own words.

### I. PROBLEMS TO WORK ON AND SUBMIT

1) Derive the probability density function amplitude of the following complex random variable:

$$h = \sqrt{\frac{\kappa}{\kappa+1}} \sigma e^{j\theta} + \sqrt{\frac{1}{\kappa+1}} \mathcal{CN}(0, \sigma^2), \quad (1)$$

where  $\theta$ ,  $\sigma$ , and  $\kappa$  are given parameters.

2) Exercise 2.1 from [Tse & Viswanath]  
 3) Exercise 2.3 from [Tse & Viswanath]  
 4) Exercise 2.11 from [Tse & Viswanath]  
 5) Exercise 2.17 from [Tse & Viswanath]

### II. PROBLEMS TO WORK ON BUT NOT SUBMIT

1) One way to determine whether the inverse-square power law of the inverse-fourth power law applies is to compare the distance  $d$  with the *critical distance*  $4h_t h_r / \lambda$ , where  $\lambda$  is the wavelength of the transmitted signal's carrier. Justify this by sketching the received power as a function of distance, and explaining its behavior.  
 2) Problem 2-14 from [Goldsmith]