**Chapter 1 Quick Notes**

**Closed form expression** is a mathematical expression that uses a finite number of standard operations. It may contain constants, variables, certain well-known operations, and functions, but usually there is no limit, differentiation, or integration. The set of operations and functions may vary with author and context.

**Average signal to noise ratio (SNR)**

* Most of the time it is measured at the output of the receiver and is thus directly related to the data detection process itself.
* Indicator of the over fidelity of the system.
* In the context of a communication system subject to fading impairment, the more appropriate measure is the average SNR, where the term “average” refers to statistical averaging over the probability distribution of the fading. In simple mathematical terms, if γ denotes the instantaneous SNR –a random variable—at the receiver output that includes the effect of fading then:
* This upper integral defines the average SNR, where denotes the probability density function of . The instantaneous SNR is subject to a fading impairment, which adds randomness.
* Moment Generating Function:
* This is the Laplace transformation of the PDF, which if evaluated for yields the average SNR.
* In the case of a system in which diversity is present, the output SNR can be expressed as a sum of the individual channel SNRs. It is safe to assume that the channels are independent. As such, the MGF can be expressed as the product of the individual MGFs.

**Chapter 2 Quick Notes**

**Fading Channel Characterization and Modeling**

The result of various efforts is a range of relatively simple and accurate statistical models for fading channels that depend on the particular propagation environment and the underlying communication scenarios.

**Envelope and Phase Fluctuations**

When a received signal experiences fading during transmission, both its envelope and phase fluctuate over time. For coherent modulations, the fading effects on the phase can severely degrade performance unless measures are taken to compensate for them at the receiver.

* Slow and Fast Fading
* Frequency Flat and Frequency Selective Fading
* Multipath Fading

Our performance evaluation of digital communications over fading channels will generally be a function of the average SNR per symbol .

**Statistical Models**

* **Rayleigh**: Used in multipath fading with no direct line-of-sight path. The channel fading amplitude is distributed as:
* **Weibull:** This is a probability model for characterizing amplitude fading in a multipath environment, particularly that associated with mobile radio systems operating inn 800/900 MHz frequency range.
  + For a special case of this describes a Rayleigh distribution.
  + For a special case of this describes an exponential distribution.
  + For the SNR per symbol expression we have: