

## Summary of Learning Objectives - Part 1

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### 1. Free-Space Propagation

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Solve free-space propagation problems involving distance, frequency, effective aperture, antenna gain, efficiency and directivity.

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### 2. Deterministic Propagation Models

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Determine the location of Fresnel zones and the approximate path loss for a two-ray ground-reflection model and for diffraction around a knife-edge.

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### 3. Statistical Models of Average Path Loss

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Apply power-law, Okamura-Hata and log-normal path-loss models.

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### 4. Multipath Fading

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Compute the statistics of received signal level resulting from Rayleigh multipath fading: amplitude pdf, mean, second moment and second central moment. Compute the RMS excess delay spread a channel from its impulse response. Compute the spectrum from an angle of arrival distribution. Compute the level crossing rate and mean fade duration for a uniform AoA.

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### 5. Diversity

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Select the most appropriate type of diversity and diversity combining based on requirements.

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### 6. Information and Capacity

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Solve problems involving expected values, moments, correlation, autocorrelation and independence. Compute the power spectrum of a stochastic random variable. Apply the Central Limit Theorem. Compute information, entropy, mutual information and capacity for arbitrary discrete, BSC and AWGN channels. Compute BER and FER.

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### 7. Introduction to Coding

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Compute the minimum Hamming distance, rate and error-detecting and -correcting capabilities of a block code. Compute polynomial arithmetic in  $GF(2)$ . Use polynomial division to compute and verify a simple CRC.

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### 8. Error Detection and Correction

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Manually perform error detection and correction doing an exhaustive search and minimum-distance decoding. Convert between a generator matrix, parity check matrix and the parity check equations for a linear block code. Compute the syndrome for a code word. Select appropriate applications for Reed-Solomon codes and interleaving. Compute the output of a convolutional encoder. Apply puncturing, shortening, erasures, interleaving and code concatenation. Compute coding gain.