Key Formulas Quiz `1_signals.pdf`

1. Continuous-time vs. Discrete-time Signals

- Sampling (Conversion from Continuous to Discrete)
- Euler's Formula

2. Basic Discrete-time Signals

- Unit Impulse $\delta[n]$ (Definition)
- Unit Step $u[n]$ (Definition)
- Exponential Signal (Formula involving $u[n]$)
- Discrete-time Sinusoid (General cosine form)

3. Elementary Operations on Discrete-time Signals

- Time Shift
- Scaling
- Sum
- Product
- Integration (Discrete-time Running Sum)
- Differentiation (Discrete-time First-Order Difference)

4. Energy and Power of Discrete-time Signals

- Energy of a discrete-time signal $x[n]$
- Average Power of a discrete-time signal $x[n]$

5. Classes of Discrete-time Signals

- Periodic Signal (Condition for periodicity with period N)
- Periodization of a finite-support signal $\overline{x}[n]$ (to create $\tilde{x}[n]$)

6. Linear Algebra for Signals

- Inner Product of two complex vectors x, y
- Norm (Squared) and Energy (from inner product of x with itself)
- Squared Euclidean Distance between x and y (in terms of norms and inner product)
- Orthogonality Condition for two vectors x, y
- Cauchy-Schwarz Inequality

7. Signal Expansion over a Basis

- General Signal Expansion of x in terms of basis u_k and coefficients X_k
- Formula for Coefficients X_k (for an Orthogonal Basis u_k)
- Orthonormal Basis Condition (inner product of basis vectors u_k, u_l)
- Formula for Coefficients X_k (for an Orthonormal Basis u_k)
- Parseval's Relation (Energy in terms of coefficients X_k for Orthonormal Basis)
- Unitary Matrix Transform (Analysis and Synthesis formulas using U)

8. Best Approximations (Projection Theorem)

- Best K-term Approximation $\tilde{x}$ (using K orthogonal basis vectors)
- Energy Decomposition (Original signal energy in terms of approximation and error energies)

9. Analysis and Synthesis Formulas (General)

- Analysis Formula (Coefficients X_k from signal x using analysis vectors a_k)
- Synthesis Formula (Signal x from coefficients X_k using synthesis vectors s_k)
- Biorthogonality Condition (between analysis a_k and synthesis s_k vectors)