ECE 417, Spring 2016: Exam 1 Solutions

Problem 1  (15 points)

\[ x[n] \xrightarrow{\text{Cepstrum}} \hat{x}[n] - \hat{s}[n] \xrightarrow{\text{Cepstrum}^{-1}} s[n] \]

- **Cepstrum:** \( \hat{x}[n] = Z^{-1} \{ \ln Z \{ x[n] \} \} \)
- **Subtract:** \( \hat{s}[n] = \hat{x}[n] - \hat{h}[n] \)
- **Cepstrum\(^{-1}\):** \( s[n] = Z^{-1} \{ \exp Z \{ \hat{s}[n] \} \} \)

Problem 2  (15 points)

\[ \hat{x}[n] = \hat{s}[n] + \sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{k} (0.9)^k \delta[n - 80k] \]

Problem 3  (20 points)

\[ k_m = \frac{700N}{F_s} \left( \left( 1 + \frac{F_s}{1400} \right)^{m/M} - 1 \right) \]

Problem 4  (30 points)

1. \( U^T \bar{u}_3 = [0, 0, 1, 0, \ldots, 0]^T \)
2. \( V \propto AU \) (any constant of proportionality is an acceptable answer).

Problem 5  (20 points)

\[ \sum_{k=1}^{K} \lambda_k = (0.95) \sum_{k=1}^{M} \lambda_k \]