

25% 1) Describe the following terminologies:

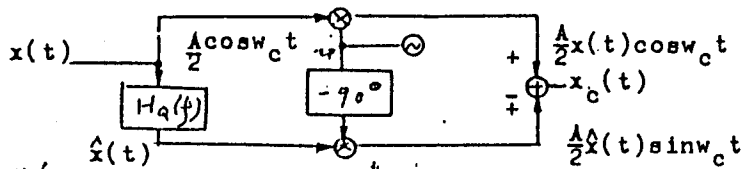
- a. Nyquist's rate.
- b. Skip zone of wave propagation.
- c. Entropy.
- d. Hamming distance.
- e. ISI.

15% 2) Prove that the impulse response of a matched filter to the input signal $f(t)$ is

$$h(t) = kf^*(t_m - t).$$

where k is a constant.

15% 3) The diagram shown below is a phase-shift method for SSB generation. Obtain an approximate expression for x_c at the output when $x(t) = \cos \omega_m t$ and the quadrature phase shifter has $|H_q(f_m)| = 1 - \epsilon$ and $\arg H_q(f_m) = -90^\circ + \delta$, where ϵ and δ are small errors. Write your answer as a sum of two sinusoids.



15% 4) A $(3, 1, 2)$ convolutional encoder achieves maximum free distance when $x_j = m_{j-2} \oplus m_j$; $x_j = x_j = m_{j-1} \oplus x_j$. Construct the code trellis and state diagram. Then find the state and output sequence produced by the input sequence 101001111.

15% 5) Describe Parseval's power theorem, and derive the theorem from the time domain to the frequency domain.

15% 6) The stationary random process $x(t)$ has a power spectral density $S_x(\omega)$. Find the power spectral density of $y(t) = x(t) - x(t-T)$.

$$x(t) = \begin{cases} 1 - |t| & |t| < 1 \\ 0 & |t| > 1 \end{cases}$$