1. \[ x(t) = \sum b(n) p(t-nT) \]

\[ S_{xx}(f) = \frac{1}{T_s} \sigma_b^2 |P(f)|^2 + \frac{m_b^2}{T_s^2} \sum_k \left| P(k/T_s) \right|^2 \delta(f - k/T_s) \]

\[ m_b = 0, \quad P(f) = T_s \text{sinc}(T_s f) \]

\[ S_{xx}(f) = \sigma_b^2 T_s \text{sinc}^2(T_s f) \]

---

2. The transmitted phase \( \phi(t) \)

Sequence: \(-1, -1, +1, -1, +1, +1, +1\)

Evaluate: \(-\pi/2, -\pi, -3\pi/2, -\pi, -\pi/2, 0\)

---

Diagram:

- Vertical axis from \(-2\pi\) to \(2\pi\) with points at \(-\pi, -\pi/2, 0, \pi/2, \pi, 3\pi/2, 2\pi\)
- Horizontal axis from \(-2\pi\) to \(2\pi\) with points at \(-\pi, -\pi/2, 0, \pi/2, \pi, 3\pi/2, 2\pi\)
- Connections between points indicating phase transitions

Diagram contains labels such as 'DopM-4'.
3. \( \phi_1(t) = \sqrt{\frac{2}{\pi t_0}} \cos(2\pi f_c t) \)
\( \phi_2(t) = -\sqrt{\frac{2}{\pi t_0}} \sin(2\pi f_c t) \)

The waveforms are

\( s_1(t) = -\frac{2}{\sqrt{10}} \phi_1(t) + \frac{3}{\sqrt{10}} \phi_2(t) \)

\( s_2(t) = \frac{1}{\sqrt{10}} \phi_1(t) + \frac{1}{\sqrt{10}} \phi_2(t) \)

\( s_3(t) = -\frac{3}{\sqrt{10}} \phi_1(t) - \frac{1}{\sqrt{10}} \phi_2(t) \)

\( s_4(t) = -\frac{1}{\sqrt{10}} \phi_1(t) - \frac{3}{\sqrt{10}} \phi_2(t) \)

\( s_5(t) = \frac{1}{\sqrt{10}} \phi_1(t) + \frac{3}{\sqrt{10}} \phi_2(t) \)

\( s_7(t) = \frac{3}{\sqrt{10}} \phi_1(t) + \frac{1}{\sqrt{10}} \phi_2(t) \)

\( s_8(t) = -\frac{1}{\sqrt{10}} \phi_1(t) + \frac{3}{\sqrt{10}} \phi_2(t) \)

4. For CDMA:

\[ P_k = \alpha \left( \frac{W \| F_k \|^2}{B} \right) \]

\( P_k \) = Received power given use
\( \frac{N_0}{2} \) = Noise variance
\( E_k \) = Energy of \( k \)th user
\( W \) = channel bandwidth
\( B \) = Information rate
The nearest problem can be explained.

The other transmission acts as noise (interference noise) to any device communicating with the base station. We see that if all devices transmit at some power, the device near to the base station jams the signals from the devices which are far off. Hence, dynamic power control is required in CDMA systems to prevent cell blocking.

(b) \( \text{Fav} = \frac{1}{5} \left( 0 + 4 \cdot 2 \cdot \frac{d^2}{4} \right) = \frac{2d^2}{5} \)

\[ P_M \leq 4Q \left( \frac{\sqrt{3d^2}}{\sqrt{(M-1)No}} \right) \leq 4Q \left( \frac{\sqrt{3d^2}}{10No} \right) \]

6. (a) \[
\begin{align*}
-\frac{\sqrt{5}}{2} & \quad -\frac{\sqrt{5}}{2} \\
\frac{\sqrt{5}}{2} & \quad -\frac{\sqrt{5}}{2} \\
\end{align*}
\]
(b) Shifting left or right ↑ Eav
Note: Equivalent: ) same structure. 

OPSK is not correct answer.

We have to shift up.

The terms involving y in Eav are

\[
p(y) = 3y^2 + (2\sqrt{5} - y)^2
\]

\[
\frac{dp(y)}{dy} = 0 \quad \Rightarrow \quad 6y + 2(2\sqrt{5} - y) = 0
\]

\[8y = 4\sqrt{5}\]

\[y = \frac{\sqrt{5}}{2}.
\]

\[
\int_0^T \cos(2\pi ft + \phi_1) \cos(2\pi (f + \frac{m}{T}) t + \phi_2) \, dt
\]

\[= \frac{1}{2} \int_0^T \cos \left(\frac{4\pi ft + 2\pi mt + \phi_1 + \phi_2}{T}\right) \, dt
\]

\[+ \frac{1}{2} \int_0^T \cos \left(\frac{2\pi mt + \phi_2 - \phi_1}{T}\right) \, dt
\]

\[= \frac{1}{2} \left[ \frac{\sin \left(\frac{2\pi m + \phi_2 - \phi_1}{T}\right)}{2\pi m/T} - \frac{\sin \left(\frac{\phi_2 - \phi_1}{T}\right)}{2\pi m/T} \right]
\]

\[= 0
\]

\[\therefore \cos(2\pi ft + \phi_1) \text{ and } \cos(2\pi (f + \frac{m}{T}) t + \phi_2) \text{ are } \perp.
\]