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Mid Exam I.

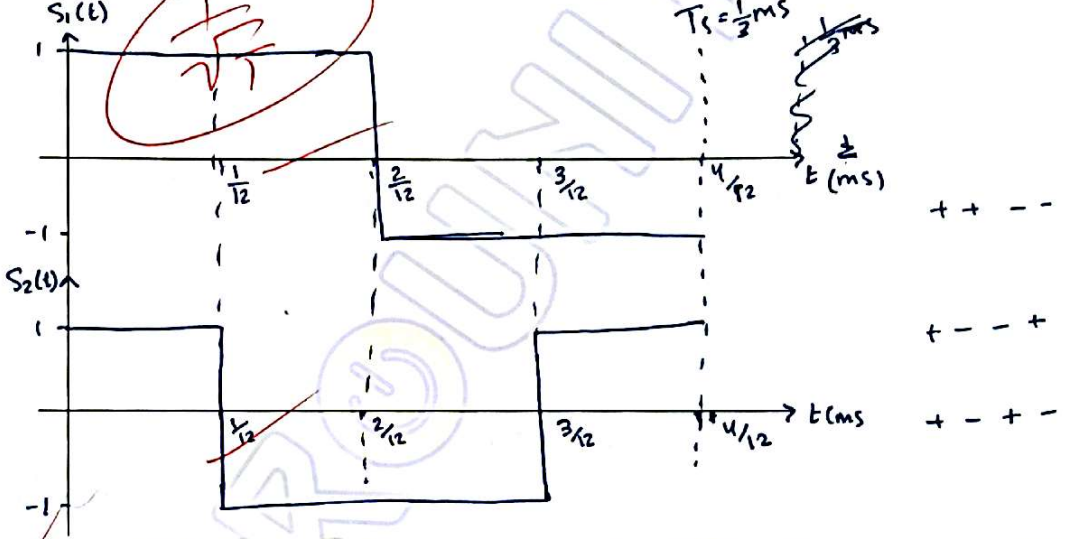
28/3/2017

Q.1 (6 Points ABET 3,3)

For band unlimited baseband channel, we need to design a 2-D constellation to transmit 4 bits at a time at 12 kbps (16-Ary QAM constellation).
 $m=4, f_b=12k, M=16$

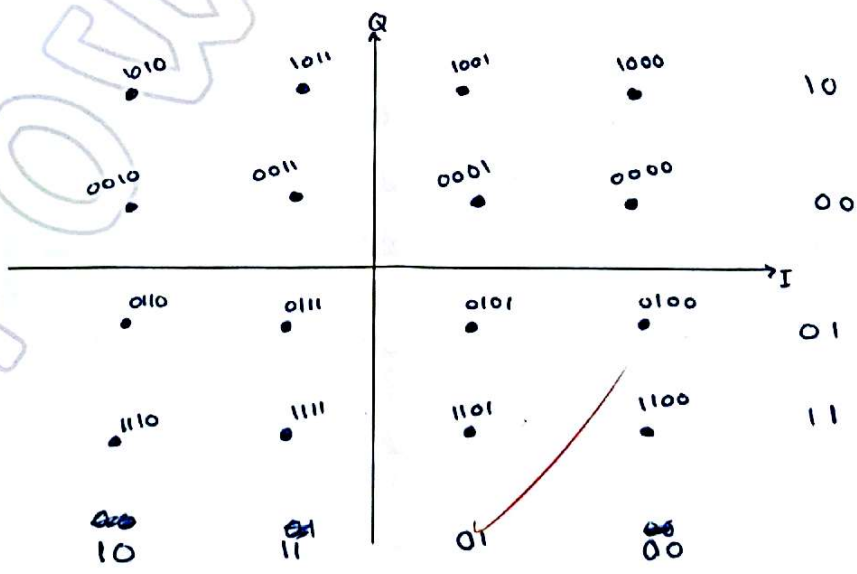
Draw the axis signals:

S_1, S_2 must be orthogonal



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Draw the constellation and label the points in binary:



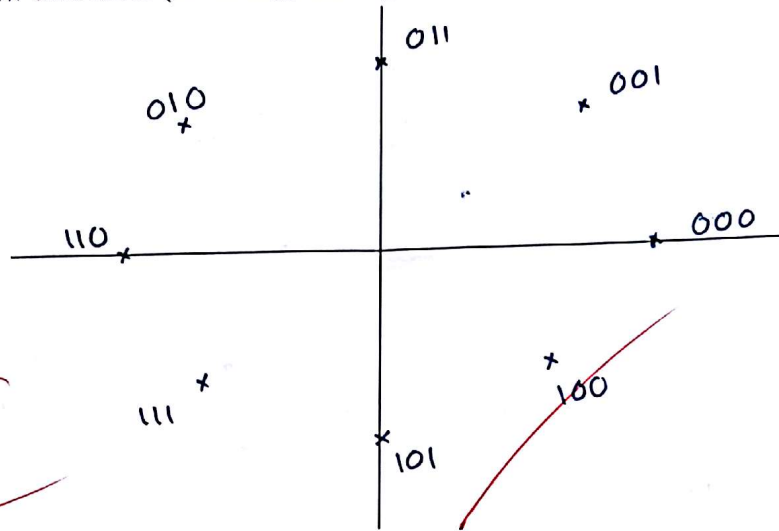
0000
0001
0010
0011
0100
0101
0110
0111
1000
1001
1010
1011

16-QAM

Q.2 (6 Points 2,1,1,2)

An 8 PSK system operating at $\overset{r_b}{200\text{kbps}}$ with carrier of $\overset{\text{bandpass}}{100\text{MHz}}$ and $\overset{f_c}{f_c}$
 $R_{C0.2}$ has minimum distance $d_{\min}=4$.
 $\alpha=0.2$

1- Draw and label (in binary) the signal constellation.



2- Find the required channel BW?

BW = 80 kHz

$\frac{200\text{kb} \cdot (1.2)}{3}$

3- Find the average power?

$P_{av} = 27.31 \text{ watt}$

$E_{avg} = T_s \cdot P_{avg}$
 $P = \frac{E}{T_s} = \frac{d_{\min}^2}{4 \sin^2(\frac{\pi}{M})}$

4- Write the general equation for the transmitted signal?

$\phi(t) = A_i p(t) \cos(\omega_c t + \theta_i) \Rightarrow A_i \cos(\theta_i)$
 $= 5.226 \cos(200\pi t + \theta_i)$
 $= 5.226 p(t) \cos(2\pi(100\text{M})t + \theta_i)$

Q.3 (6 Points 3,3)

For a DPSK system the following table is used, then Draw the signal constellation and find the minimum distance if the signal power is 8 watts.

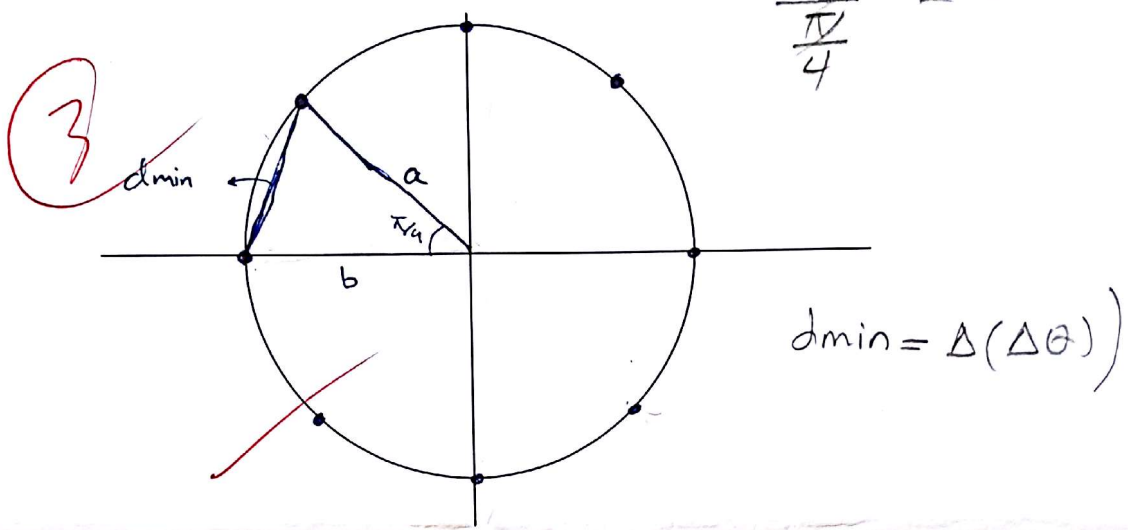
x	$\Delta\theta$
0	$-\pi/4$
1	$-\pi/2$

$\frac{\pi}{4}$

$P = r^2$
 $r = \sqrt{P}$
 $d_{min} = a^2 + b^2 - 2ab \cos\theta$
 $= 8 + 8 - 2 \cdot 8 \cos(\frac{\pi}{4})$

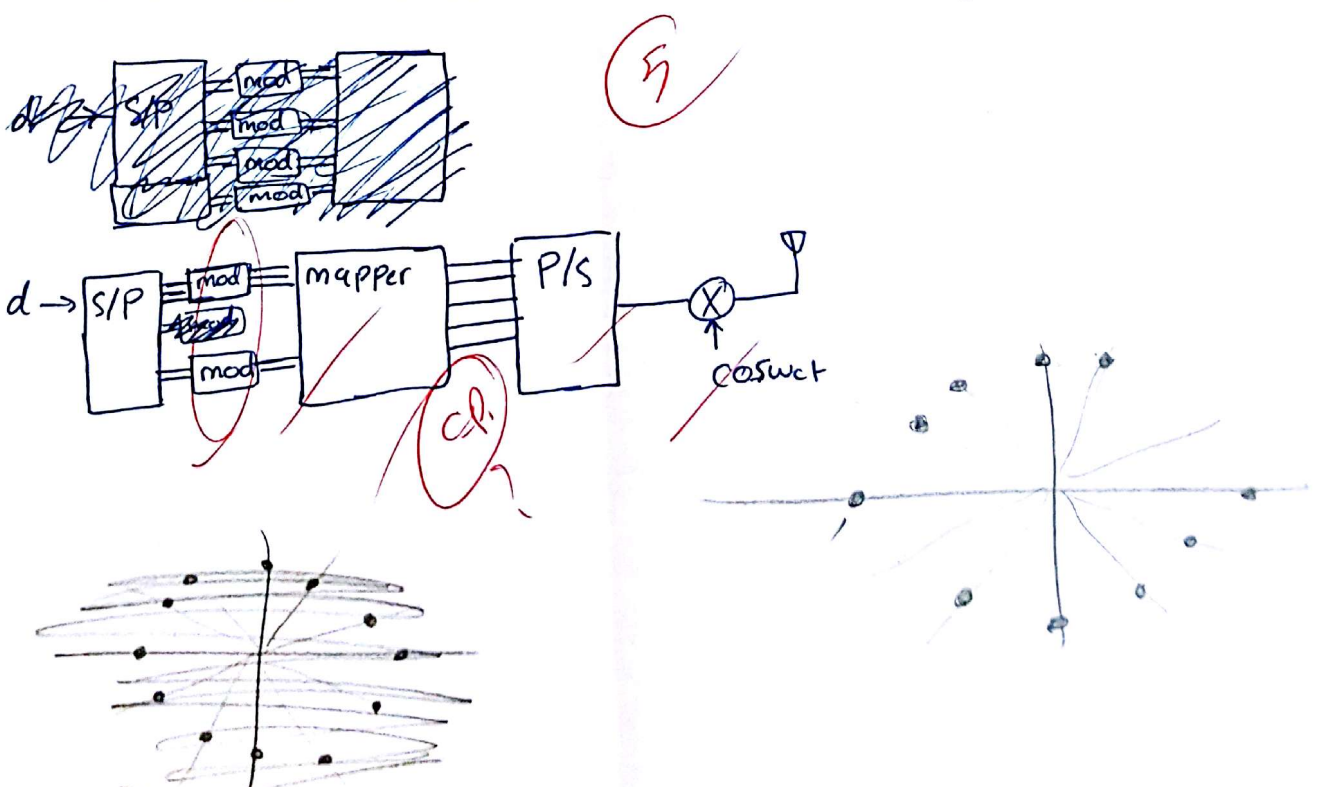
$d_{min} = 4.686$

$\frac{2\pi}{\frac{\pi}{4}} = 8$



Q.4 (6 Points)

Draw the OFDM modulator for 8 sub-carriers each with a 4PSK signal.



Q.5 (6 Points 1 each)

1.	Antipodal signals are used as carrier waveforms.	<input checked="" type="radio"/> T	<input type="radio"/> F
2.	Two dimensional modulation is possible in band limited band pass systems.	<input type="radio"/> T	<input checked="" type="radio"/> F
3.	IF BPF is used to limit the noise bandwidth.	<input checked="" type="radio"/> T	<input type="radio"/> F
4.	Raised Cosine waveform is used to shape the spectrum of the modulated signals.	<input checked="" type="radio"/> T	<input checked="" type="radio"/> F
5.	FSK has the best performance in fading channels.	<input checked="" type="radio"/> T	<input type="radio"/> F
6.	Errors may propagate in Partial response signaling.	<input checked="" type="radio"/> T	<input type="radio"/> F

→ the answer is False

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