EHB 352E - DIGITAL COMMUNICATION

Homework 2

In binary passband digital communication system 0 and 1 information bits with P_0 and P_1 probabilities are transmitted with following modulated signals respectively. Additive White Gaussian noise with zero mean and double sided power spectral density $N_0/2$ is introduced in the channel.

$$s_0(t) = \frac{1}{\sqrt{2}}\cos 500\pi t + \frac{1}{\sqrt{2}}\sin 500\pi t \ , 0 \le t \le T$$

$$s_1(t) = \frac{1}{\sqrt{2}}\cos 500\pi t - \frac{1}{\sqrt{2}}\sin 500\pi t \ , 0 \le t \le T$$

a) Write the modulation type and briefly explain it.

b) Sketch the block diagram of optimum receiver with correlation receiver(or matched filter) that makes probability of error minimum.

c) Find average energy spent for each bit E_b.

d) In the absence of noise find the corresponding values at the input of decision device in terms of average energy spent for each bit E_b.

e) Find the noise power at the input of decision device in terms of E_b and N_0.

f) Find the optimum threshold levels and minimum error probability in terms of E_b and N_0 if $P_0 = 1/3$ and $P_1 = 2/3$.

g) New symbol set is introduced into the system instead of s_0 and s_1, such as

$$s_{00}(t) = \frac{1}{\sqrt{2}}\cos 500\pi t + \frac{1}{\sqrt{2}}\sin 500\pi t \ , 0 \le t \le T$$

$$s_{01}(t) = \frac{1}{\sqrt{2}}\cos 500\pi t - \frac{1}{\sqrt{2}}\sin 500\pi t \ , 0 \le t \le T$$

$$s_{10}(t) = -\frac{1}{\sqrt{2}}\cos 500\pi t + \frac{1}{\sqrt{2}}\sin 500\pi t \ , 0 \le t \le T$$

$$s_{11}(t) = -\frac{1}{\sqrt{2}}\cos 500\pi t - \frac{1}{\sqrt{2}}\sin 500\pi t \ , 0 \le t \le T$$

find the optimum threshold levels and minimum error probability in terms of E_b and N_0 if $P_0 = 1/2$ and $P_1 = 1/2$.