53 (EC 712) SSCM

2013

(December)

SPREAD SPECTRUM COMMUNICATION

Paper : EC 712

Full Marks : 100

Pass Marks : 30

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Show that the error probability for a PSK signal is given by $P_e/_{PSK} = \frac{1}{2} erfc\left(\sqrt{\frac{E_b}{\eta}}\right)$; where the symbols have their usual meaning.

(b) Consider a binary optimum system with source probabilities $P_1 \triangleq P(m_1)$ and $P_2 \triangleq P(m_2)$ for messages m_1 and m_2 respectively. Show that for such a system, the threshold voltage is given by

$$V_T = \frac{E_2 - E_1}{2} + \frac{N_0}{2} ln\left(\frac{P_1}{P_2}\right);$$

where 'E_i' is the signal energy 'N_0' is the two sidedpower spectral density.

12+8

2. Find an expression for the maximum bit error probability in case of a pulse noise jamming, Hence show that the optimised pulse noise jamming can cause a degradation of approximately $31 \cdot 5dB$ relative to coutinuous jamming at a bit error probability of 10^{-5}.

12+8

3. (a) Explain the operation of a BPSK direct sequence spread spectrum system having transmission delay T_d.

(b) Draw the power spectra for the data modulated carrier and the transmitted signal. Also find an expression for the power spectral density (psd) of the transmitted signal. Assume that $T_c = T/3$; where 'T' is the time period of the data and 'T_c' is the chip duration. 10+10

4. (a) Calculate the power spectrum of the direct sequence spread spectrum transmitted signal when BPSK is used for both the data modulation and the spreading code modulation. Assume that the spreading code is 200 times the data rate, and the period of the spreading code is infinite.

(b) Suppose that BPSK is used for both the data modulation and the spreading modulation and that the interference is a single tone having power 'J'. Also assume that the jammer places the jamming tone directly in the center of the modem's transmission bandwidth. Show that the magnitude of the jammer power passed by an IF filter with transfer function $H(f)$ will be given by $J_0 = J \cdot T_c/T$; where the symbols have their usual significance. 12+8

5. Consider a random PAM pulse train. Show that the *psd* of such a random pulse train is given by

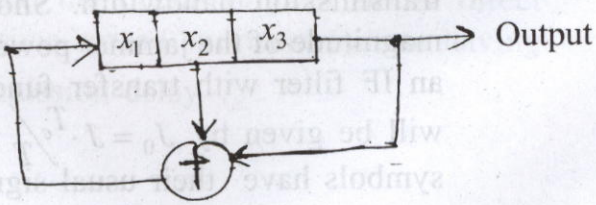
$$Sy(f)=\frac{|P(f)|^2}{T_b}\sum_{n=-\alpha}^{\infty}R_n\cdot e^{-j2\pi fnT_b}$$

where 'T_b' is the bit-period, 'R_n' is the correlation of the RVS of the amplitude. 20

6. *(a)* Explain how ranging is performed using a DS-spread spectrum system.

(b) A DSSS used for range measurement gives a range resolution of $0{\cdot}01Km$. Find the value of chip rate that is required for this purpose. 10+6+4

(c) Assume a 3-stage shift register with initial load 111. Show that for such a shift register, the output will repeat after the 7th clock pulse.



Mod-2 Adder

7. Write short notes on ***any two*** from the following : 10+10

i) FH / MFSK system.

ii) Power calculation in a single channel system using binary phase modulation.

iii) RAKE receiver.
