53 (EC 712) SSCM

2019

SPREAD SPECTRUM COMMUNICATION

Paper : EC 712

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

1. *(a)* What are the criteria for a spread spectrum communication systems to be satisfied ? 3

   (b) Show that for digital baseband signaling technique using uni-polar NRZ, the error probability decreases as the input SNR to the receiver increases. 17

2. Find an expression for the maximum bit error rate (BER) in case of pulse noise jamming. Hence show that this optimised pulse noise jammer can cause a degradation of approximately $31{\cdot}5dB$ relative to a continuous jamming at a BER of 10^{-5}. 17+3

3. *(a)* Show that a BPSK communication system using DSSS will suppress the effect of narrowband noise '$n(t)$'; you may assume that the noise arises because of narrowband interfering signal. 10

(b) Show that a BPSK communication system using DSSS can reduce the effect of multipath signal propagation and the effect of a jamming signal. 10

4. Suppose that BPSK is used for data modulation and the interference is a single tone having power 'J'. Also assume that the jammer places the jamming tone directly in the centre of the modem's transmission bandwidth. Show that the magnitude of jammer power that will be passed by an IF (Intermediate Frequency) filter with transfer function $H(f)$ is given by $J_0 = J(T_c/T)$; where the symbols have their usual meaning. 20

5. An FHSS/BFSK is used for transmitting binary data coming at the rate of $20kbps$. The unspread BFSK signal occupies a bandwidth of $25kHz$. The received signal power is $-15dBm$. A jammer which produce a received power of at the most $-20dBm$ either has a narrowband signal of $25kHz$ bandwidth or as a broadband signal occupying the full bandwidth of the FHSS system, is trying to jam the FHSS signal. If the spreading factor 'L' of the FHSS/BFSK system is 25, find the improvements in SNR (dB) under broadband jamming as compared to narrowband jamming. Assume the one-sided PSD (Power Spectral Density) of the AWGN channel to be $10^{-11}W/Hz$. 20

6. *(a)* Explain the operation of a FH/MFSK system. 10

(b) Show that in case of a single channel system using spread spectrum modulation and utilising binary phase modulation, the total power required for transmission can be obtained from the power required for transmitting the data. 10