1. **Write the advantages of Spread Spectrum communication.**

Spread-spectrum communication provides secure and reliable communication by preventing interception and resisting jamming.

1. **Classify basic types of spread spectrum techniques.**

 Direct Sequence Spread-Spectrum (DSSS)

 Frequency-Hopping Spread-Spectrum (FHSS).

1. **Describe PN Sequence.**

Two types of spread spectrum techniques relay heavily on pseudo-random noise sequence generators (PN code generators) .PN code generators use shift registers with appropriate feedback. An m stage shift register with appropriate feedback can produce PN sequences of length (2m-1). Such sequences are called maximal-length sequences.

1. **Write the properties of PN sequence.**
2. Balance property
3. Run property
4. Correlation property
5. **Describe the basic principle of DSSS.**

The basic principle of DSSS is to spread the signal power over a very large bandwidth by modulating an already BPSK modulated signal, using a spreading signal, which is a maximal-length PN sequence.

1. **How to Decode/Demodulate DSSS signal at the receiver.**

At the receiving end, the DSSS signal is first de-spread by multiplying the received signal by a PN sequence which is an exact replica of the one used for spreading at the transmitting end and is in synchronism with it. Then the BPSK signal is detected using a coherent detector.

1. **Describe Processing Gain.**

If the chip frequency fc, the inverse of Tc, the pulse width if the PN sequence used for spreading, and fb is the inverse of the bit rate of the data then the ratio (fc/fb) is called the processing gain of the DSSS system and it determines the degree of resistance offered by the DSSS signal to jamming.

1. **Write the applications of DSSS technique.**

DSSS signals can be used for ranging and accuracy attainable increases with the chip frequency.

1. **Explain** **FHSS operation at transmitter.**

In FHSS, a BFSK or M-ary FSk signal is again modulated by a carrier signal whose frequency goes on hopping from one value to another from among a given set of values, at regular intervals of Tc, the chip period, according to a predetermined pseudo-random pattern.

1. **Explain demodulation process of FHSS method.**

As phase coherence cannot be maintained in FHSS, only non coherent detection is possible. Hence, only BFSK or M-ary BFSK signals are used.

1. **Explain the role of synchronization in spread spectrum.**

In DSSS as well as FHSS, it is necessary to maintain perfect alignment between the PN sequences used at the transmitter and the receiver. Synchronization of the PN sequences is done in two stages. The first stage, called acquisition, achieves coarse alignment, while the second stage, called tracking, achieves perfect synchronization.

1. **Write the necessity of Gold codes.**

For CDMA applications, a large number of distinct PN codes must be available and they should have auto-correlation characteristics similar to those of white noise and the cross-correlation between any two must be ideally zero. Gold codes satisfy all these requirements.

1. **Classify spread spectrum based on modulation employed.**
2. Direct sequence

 ii. frequency hopping

iii. time hopping

iv. hybrid models

1. **Write the advantages of Spread Spectrum.**
2. Antijam capability
3. Interference rejection
4. Multiple access capability
5. Multipath protection
6. Low probability of interrupt
7. Secure communication
8. Improved spectral efficiency
9. What is the maximum length of a PN sequence that can be generated using a 4- stage shift register?

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1. **What is the auto-correlation of the output of a PN sequence generator?**

Deterministic and periodic.

1. **Define acquisition.**

The first stage of alignment of the PN generator at the receiver with that at the transmitter is called Acquisition.

1. **Define Tracking.**

The second stage of alignment of the PN generator at the receiver with that at the transmitter is called tracking.

1. **What is the processing gain of the DSSS system?**

Gp ∆ fc/fb

1. **What are the types of jamming?**
2. White noise or barrage jamming
3. Partial-band jamming