- Constellation diagrams - Euclidean distance - Bfsk, bpsk, qpsk 1) What is BFSK 2) Draw Constellation Diagram of BFSK 3) What is Eucladian distance and it's value for BFSK 4) What is BER and it's value for BFSK 5) What is Random process and random variable, give example 6) What is Mean, variance and standard deviation 7) difference between shannon fano and huffman 8) What is difference between BPSK and QPSK 9) What is LBC and Cyclic code 10) What is ISI 11) What is Entropy and what are it's types, write equation for all types DC oral questions : What is DSSS? What is the purpose of DSSS and how it is obtained? What is FHSS? Difference between DSSS and FHSS? What is random process ? What is random variable? What is autocorrelation? What is cross correlation? What is entropy ? What is Information? Difference between Shannon Fano and Huffman algorithms. What is BFSK? Difference between BFSK and BPSK and QPSK. Phase differences in above mentioned processes. What is ISI? What is equalizer? What is source coding theorem and channel coding theorem? What is transmitter and its purpose? qam ber vs snr What is ber? Formulas for entropy 1. Full form of ISI , what is ISI? 2. ⁠what is equilizer? 3. ⁠source coding and channel coding 4. ⁠LBC and Cyclic coding 5. ⁠what is random process, autocorrelation , crosscorrelation 6. ⁠FHSS and DSSS basic difference 7. ⁠what is BPSK , Difference between BPSK and BFSK 8. ⁠types of random processes

**ChatGPT said:**

ChatGPT

Hello, K! Alright, let’s tackle these questions thoroughly in a Q&A format, as requested:

**1. What is BFSK?**

**Answer**: Binary Frequency Shift Keying (BFSK) is a frequency modulation technique where two distinct frequencies represent binary values (0 and 1). A higher frequency represents one binary state (say 1) and a lower frequency represents the other binary state (0).

**2. Draw Constellation Diagram of BFSK**

**Answer**: In BFSK, the constellation diagram shows two distinct points, each representing the different frequencies for 0 and 1. Unlike phase-shift keying (e.g., BPSK), BFSK doesn’t shift phase but shifts between two frequencies. So, the diagram has two points aligned on the real axis at different frequencies.

**3. What is Euclidean Distance and Its Value for BFSK?**

**Answer**: Euclidean distance is the straight-line distance between two points in a constellation diagram. In BFSK, the Euclidean distance depends on the separation of the two frequencies. The distance d*d* can be calculated as:

d=∣f1−f0∣*d*=∣*f*1​−*f*0​∣

where f1*f*1​ and f0*f*0​ are the frequencies used to represent binary 1 and 0, respectively.

**4. What is BER and Its Value for BFSK?**

**Answer**: Bit Error Rate (BER) is the probability of errors occurring in data transmission. For BFSK, BER is influenced by factors like noise and the Euclidean distance between the two frequencies. The BER for BFSK in an additive white Gaussian noise (AWGN) channel can be approximated by:

BER=Q(Δf2N0)BER=*Q*(2*N*0​​Δ*f*​)

where Q*Q* is the Q-function, ΔfΔ*f* is the frequency separation, and N0*N*0​ is the noise spectral density.

**5. What is a Random Process and Random Variable? Give an Example.**

**Answer**: A *random process* is a collection of random variables indexed by time or space, describing phenomena evolving randomly over time (e.g., noise in a communication channel). A *random variable* is a variable that can take multiple values, each with an associated probability (e.g., outcome of a dice roll).

**6. What is Mean, Variance, and Standard Deviation?**

**Answer**:

* **Mean**: Average value of a data set or random variable.
* **Variance**: Measure of how much the values in a data set vary from the mean.
* **Standard Deviation**: Square root of the variance, indicating the spread of data.

**7. Difference Between Shannon-Fano and Huffman**

| **Aspect** | **Shannon-Fano** | **Huffman** |
| --- | --- | --- |
| **Method** | Top-down approach | Bottom-up approach |
| **Optimality** | May not be optimal | Always produces optimal code |
| **Tree Construction** | Splits symbols into two halves | Builds tree based on lowest frequencies first |
| **Efficiency** | Less efficient than Huffman | More efficient |
| **Example** | Used in some early compression schemes | Widely used in JPEG, MP3, etc. |

**8. What is the Difference Between BPSK and QPSK?**

| **Aspect** | **BPSK** | **QPSK** |
| --- | --- | --- |
| **Bits per Symbol** | 1 bit per symbol | 2 bits per symbol |
| **Constellation Points** | 2 points | 4 points |
| **Bandwidth Efficiency** | Lower than QPSK | Higher bandwidth efficiency |
| **Phase Shift** | 180 degrees | 90 degrees |
| **Example** | Basic wireless modems | 4G/LTE and Wi-Fi |

**9. What is LBC and Cyclic Code?**

**Answer**: *Linear Block Code (LBC)* is a type of error-correcting code where each code word is a linear combination of the input bits. *Cyclic Code* is a subtype of LBC with the property that any cyclic shift of a codeword is also a codeword.

**10. What is ISI?**

**Answer**: *Inter-Symbol Interference (ISI)* is a form of signal distortion in which one symbol interferes with subsequent symbols. It occurs due to multipath propagation and bandwidth limitations, degrading signal quality.

**11. What is Entropy and Its Types? Write Equations.**

**Answer**: Entropy is a measure of information uncertainty in a source. It represents the average information content per message.

* **Shannon Entropy**: H(X)=−∑p(x)log⁡2p(x)*H*(*X*)=−∑*p*(*x*)log2​*p*(*x*)
* **Conditional Entropy**: Measures uncertainty in X*X* given Y*Y*: H(X∣Y)=−∑p(x,y)log⁡p(x∣y)*H*(*X*∣*Y*)=−∑*p*(*x*,*y*)log*p*(*x*∣*y*)

**DC Oral Questions:**

1. **What is DSSS?**
   * *Direct Sequence Spread Spectrum (DSSS)* is a spread-spectrum modulation technique where a data signal is multiplied by a high-rate pseudorandom noise code, spreading the signal over a wider frequency band.
2. **What is the Purpose of DSSS and How Is It Obtained?**
   * *Purpose*: To improve signal security, reduce interference, and resist jamming.
   * *Obtained By*: Multiplying data with a pseudorandom sequence, effectively “spreading” the signal.
3. **What is FHSS?**
   * *Frequency Hopping Spread Spectrum (FHSS)* is a method where the carrier frequency changes (hops) at regular intervals across a range of frequencies.
4. **Difference Between DSSS and FHSS?**

| **Aspect** | **DSSS** | **FHSS** |
| --- | --- | --- |
| **Technique** | Signal spread over a continuous range | Carrier frequency hops across channels |
| **Interference** | Reduced narrowband interference | Resistant to wideband interference |
| **Application** | GPS, CDMA | Bluetooth, Wi-Fi |

**Further Technical Questions**

1. **What is Random Process?**
   * A *random process* is a set of random variables indexed over time, representing random variation in signals.
2. **What is Autocorrelation?**
   * Autocorrelation measures the similarity between a signal and a time-delayed version of itself.
3. **What is Cross Correlation?**
   * Cross-correlation measures the similarity between two different signals.
4. **What is Entropy?**
   * Entropy quantifies the uncertainty or randomness in information, indicating the average information content.
5. **What is Information?**
   * Information is data that reduces uncertainty, measurable in bits.
6. **Difference Between Shannon-Fano and Huffman Algorithms**  
   (As discussed earlier in question #7)
7. **What is Equalizer?**
   * An equalizer compensates for distortion in the communication channel, reducing ISI.
8. **What is Source Coding Theorem and Channel Coding Theorem?**
   * *Source Coding Theorem*: Minimum average length for encoding data without loss.
   * *Channel Coding Theorem*: Maximum transmission rate with error-free communication.

**You said:**

Add some more, which according to you might be important

**ChatGPT said:**

ChatGPT

Sure thing, K! Let’s cover some additional topics that could be crucial for a comprehensive understanding in Digital Communication (DC). Here are some extra points that often come up in exams or oral assessments:

**1. What is QAM (Quadrature Amplitude Modulation)?**

* **Answer**: Quadrature Amplitude Modulation (QAM) is a modulation scheme that combines amplitude and phase modulation. It encodes data by varying both the amplitude and phase of the carrier signal. QAM is widely used in applications requiring high data rates, such as Wi-Fi and digital TV.
* **Example**: 16-QAM uses 16 unique combinations of amplitude and phase to represent 4 bits per symbol.

**2. BER vs. SNR in QAM**

* **Answer**: The Bit Error Rate (BER) decreases as the Signal-to-Noise Ratio (SNR) increases, meaning a cleaner signal results in fewer errors. Higher-order QAM, like 64-QAM, has higher BER at the same SNR compared to lower-order QAM (e.g., 16-QAM) due to closer constellation points.

**3. What is Nyquist Rate and Nyquist Criterion?**

* **Answer**: The *Nyquist Rate* is the minimum sampling rate required to avoid aliasing, which is twice the maximum frequency of the signal (i.e., fs≥2fmax*fs*​≥2*fmax*​). The *Nyquist Criterion* states that sampling above this rate preserves signal integrity, essential in digital signal processing.

**4. What is Gaussian Noise?**

* **Answer**: Gaussian noise is a statistical noise with a probability density function (PDF) equal to that of the normal distribution. In communication, it’s a common noise model as it closely approximates the noise in electronic systems.

**5. What is AWGN (Additive White Gaussian Noise)?**

* **Answer**: AWGN is a noise model where the noise added to the signal is Gaussian and has a flat spectral density (white noise). It’s a fundamental noise model in communication system analysis, simplifying BER calculations and performance estimation.

**6. Coherent vs. Non-Coherent Detection**

| **Aspect** | **Coherent Detection** | **Non-Coherent Detection** |
| --- | --- | --- |
| **Synchronization** | Requires phase synchronization | Does not require phase synchronization |
| **Performance** | Better performance, lower BER | Slightly worse due to lack of sync |
| **Complexity** | Higher | Lower |
| **Example** | BPSK, QPSK (coherent modulations) | BFSK, DPSK (non-coherent modulations) |

**7. What is Fading? Types of Fading?**

* **Answer**: *Fading* refers to variations in signal amplitude and phase due to multipath propagation.
  + *Types*:
    - **Rayleigh Fading**: No line-of-sight path; common in urban environments.
    - **Rician Fading**: Includes a line-of-sight component, used for suburban or rural areas.

**8. What is Multiplexing and Its Types?**

* **Answer**: Multiplexing allows multiple signals to share a single communication channel, enhancing bandwidth efficiency.
* **Types**:
  + **Time Division Multiplexing (TDM)**: Divides time into slots for each signal.
  + **Frequency Division Multiplexing (FDM)**: Allocates separate frequencies for each signal.
  + **Code Division Multiplexing (CDM)**: Uses unique codes for each signal (used in CDMA).

**9. Channel Capacity and Shannon’s Capacity Formula**

* **Answer**: *Channel Capacity* is the maximum data rate a channel can support with minimal errors. Shannon’s Capacity Formula defines it as:

C=Blog⁡2(1+SN)*C*=*B*log2​(1+*NS*​)

where C*C* is channel capacity in bits per second, B*B* is bandwidth, and SN*NS*​ is the signal-to-noise ratio.

**10. What is Digital Modulation and Its Types?**

* **Answer**: Digital Modulation is the process of transferring digital data over analog carrier waves.
  + *Common Types*:
    - **ASK (Amplitude Shift Keying)**: Varies amplitude.
    - **FSK (Frequency Shift Keying)**: Varies frequency.
    - **PSK (Phase Shift Keying)**: Varies phase.
    - **QAM (Quadrature Amplitude Modulation)**: Combines amplitude and phase changes.

**11. What is Probability Density Function (PDF) and Cumulative Distribution Function (CDF)?**

* **PDF**: Shows the probability of a random variable within a particular range.
* **CDF**: Shows the cumulative probability that a random variable takes on a value less than or equal to a specific point.

**12. Orthogonal Frequency Division Multiplexing (OFDM)**

* **Answer**: OFDM is a type of frequency division multiplexing where subcarriers are orthogonal, meaning they don’t interfere with each other. Used in Wi-Fi, LTE, and digital broadcasting, OFDM offers high spectral efficiency and robustness against multipath fading.

**13. Error Detection and Correction Codes**

* **Answer**: These codes detect and/or correct errors in data transmission.
  + *Types*:
    - **Parity Bit**: Simple error detection.
    - **CRC (Cyclic Redundancy Check)**: Powerful error detection.
    - **Hamming Code**: Single-bit error correction.
    - **Reed-Solomon**: Multi-bit error correction.

**14. Basics of Turbo Codes and LDPC Codes**

* **Turbo Codes**: Concatenated codes that offer high performance close to Shannon's limit, used in deep-space communication and LTE.
* **LDPC (Low-Density Parity-Check) Codes**: Error-correcting codes with sparse matrices, providing good performance in high-speed applications.

**15. What is Signal-to-Noise Ratio (SNR)?**

* **Answer**: SNR is the ratio of signal power to noise power, representing signal clarity. Higher SNR indicates better signal quality and fewer errors.

**16. Adaptive Equalization**

* **Answer**: Adaptive Equalizers dynamically adjust to compensate for time-varying channel impairments (e.g., fading). Used in modern receivers to reduce ISI and improve data integrity.

DC viva questions Practical exp- BFSK 1) What is BFSK 2) Draw Constellation Diagram of BFSK 3) What is Eucladian distance and it's value for BFSK 4) What is BER and it's value for BFSK 5) What is Random process and random variable, give example 6) What is Mean, variance and standard deviation 7) difference between shannon fano and huffman 8) What is difference between BPSK and QPSK 9) What is LBC and Cyclic code 10) What is ISI 11) What is Entropy and what are it's types, write equation for all types

**ChatGPT said:**

ChatGPT

Here’s a brief guide to each of these questions:

1. **What is BFSK (Binary Frequency Shift Keying)?**
   * BFSK is a digital modulation technique where two different frequencies represent binary '0' and '1'. It’s commonly used in low-bandwidth, narrowband communication.
2. **Draw Constellation Diagram of BFSK**
   * The constellation diagram for BFSK shows two points on the real axis, corresponding to the two frequencies used for '0' and '1'. Since it's frequency-based, points are typically separated in frequency space rather than phase or amplitude space.
3. **What is Euclidean Distance, and its value for BFSK?**
   * Euclidean distance refers to the geometric distance between points in the signal space. For BFSK, the Euclidean distance depends on the frequencies and energy of the signals. For simple BFSK with orthogonal signals, the distance between symbols is usually twice the amplitude of the signals.
4. **What is BER (Bit Error Rate), and its value for BFSK?**
   * BER is the rate of erroneous bits received to the total bits transmitted. For BFSK, BER can be calculated based on noise level and is often given by BER=Q(2EbN0)BER=*Q*(*N*0​2*Eb*​​​) for coherent detection.
5. **What is a Random Process and Random Variable? Give an example.**
   * A random process is a collection of random variables indexed by time, representing systems evolving over time (e.g., noise signals). A random variable is a variable whose values depend on outcomes of a random phenomenon, such as the outcome of a coin flip.
6. **What is Mean, Variance, and Standard Deviation?**
   * **Mean** is the average value of a set of data.
   * **Variance** measures how spread out the values are from the mean.
   * **Standard Deviation** is the square root of the variance, indicating the data spread in the same units as the data.
7. **Difference Between Shannon-Fano and Huffman Coding**
   * Shannon-Fano is a top-down approach to entropy encoding, while Huffman is a bottom-up, more efficient method, which produces a unique prefix code and minimizes the average code length.
8. **What is the Difference Between BPSK and QPSK?**
   * **BPSK (Binary Phase Shift Keying)** modulates data using two phases (0 and 180 degrees), while **QPSK (Quadrature Phase Shift Keying)** uses four phases (0, 90, 180, 270 degrees), encoding 2 bits per symbol, making QPSK more bandwidth efficient.
9. **What is Linear Block Code (LBC) and Cyclic Code?**
   * **LBC**: A code where any linear combination of code words is also a code word.
   * **Cyclic Code**: A type of LBC where a cyclic shift of a code word results in another valid code word.
10. **What is ISI (Inter-Symbol Interference)?**
    * ISI is a distortion in signal transmission where one symbol interferes with subsequent symbols, often due to multipath propagation or bandwidth limitations, causing a decrease in clarity and increased error rate.
11. **What is Entropy, and What are its Types? Write the Equation for Each Type.**
    * **Entropy** measures the average information content or uncertainty of a random variable. Types include:
      + **Shannon Entropy** H(X)=−∑p(x)log⁡2p(x)*H*(*X*)=−∑*p*(*x*)log2​*p*(*x*), which quantifies uncertainty.
      + **Conditional Entropy** H(Y∣X)=−∑p(x,y)log⁡2p(y∣x)*H*(*Y*∣*X*)=−∑*p*(*x*,*y*)log2​*p*(*y*∣*x*), which measures remaining uncertainty given another variable.

**You said:**

DC oral questions : What is DSSS? What is the purpose of DSSS and how it is obtained? What is FHSS? Difference between DSSS and FHSS? What is random process ? What is random variable? What is autocorrelation? What is cross correlation? What is entropy ? What is Information? Difference between Shannon Fano and Huffman algorithms. What is BFSK? Difference between BFSK and BPSK and QPSK. Phase differences in above mentioned processes. What is ISI? What is equalizer? What is source coding theorem and channel coding theorem? What is transmitter and its purpose? Title 16 qam ber vs snr What is ber? Formulas for entropy

**ChatGPT said:**

ChatGPT

Here’s an overview of answers to your oral questions:

1. **What is DSSS (Direct Sequence Spread Spectrum)?**
   * DSSS is a spread-spectrum technique where the signal is spread over a wider bandwidth by multiplying it with a pseudo-random code, which increases its resistance to interference and eavesdropping.
2. **What is the Purpose of DSSS and How is it Obtained?**
   * The purpose of DSSS is to reduce interference, improve security, and increase signal robustness. It is obtained by multiplying the data signal with a pseudo-random spreading code at a much higher rate than the data rate, spreading the signal across a broader frequency spectrum.
3. **What is FHSS (Frequency Hopping Spread Spectrum)?**
   * FHSS is a spread-spectrum method where the signal rapidly switches (or "hops") between different frequencies within a designated bandwidth. The hopping pattern is determined by a pseudo-random sequence known to both transmitter and receiver.
4. **Difference Between DSSS and FHSS?**
   * DSSS spreads the signal over a wide frequency range continuously, while FHSS jumps between frequencies. DSSS provides better resistance to interference within a narrow range, whereas FHSS provides better resistance against frequency-selective fading.
5. **What is a Random Process?**
   * A random process is a collection of random variables indexed by time or space, representing phenomena that evolve randomly over time, like thermal noise.
6. **What is a Random Variable?**
   * A random variable is a variable that takes on values based on the outcome of a random event, such as the result of a dice roll.
7. **What is Autocorrelation?**
   * Autocorrelation measures the similarity between a signal and a delayed version of itself, helping analyze repeating patterns or periodic signals.
8. **What is Cross-Correlation?**
   * Cross-correlation measures the similarity between two different signals over time, used to find time delays or relationships between signals.
9. **What is Entropy?**
   * Entropy measures the average level of uncertainty or information content in a random variable, quantifying the unpredictability of information.
10. **What is Information?**
    * Information refers to data or knowledge conveyed through a message. In communication theory, information is related to reducing uncertainty.
11. **Difference Between Shannon-Fano and Huffman Algorithms:**
    * Shannon-Fano uses a top-down approach for coding, while Huffman uses a bottom-up approach that results in an optimal prefix code, usually yielding better compression.
12. **What is BFSK (Binary Frequency Shift Keying)?**
    * BFSK is a modulation scheme where two distinct frequencies represent binary '0' and '1'.
13. **Difference Between BFSK, BPSK, and QPSK:**
    * **BFSK** uses different frequencies for '0' and '1'.
    * **BPSK** uses two phases (0 and 180 degrees).
    * **QPSK** uses four phases (0, 90, 180, 270 degrees), enabling 2 bits per symbol.
14. **Phase Differences in BFSK, BPSK, and QPSK:**
    * BFSK has no phase shift since it’s frequency-based. BPSK has a 180-degree phase shift, while QPSK has 90-degree phase shifts between symbols.
15. **What is ISI (Inter-Symbol Interference)?**
    * ISI occurs when overlapping symbols interfere with one another, typically due to bandwidth limitations or multipath fading, leading to errors.
16. **What is an Equalizer?**
    * An equalizer compensates for distortions in the received signal caused by ISI, improving signal quality by filtering and balancing frequency components.
17. **What is the Source Coding Theorem and Channel Coding Theorem?**
    * **Source Coding Theorem:** Sets a limit on the minimum average number of bits needed to represent data from a source without losing information.
    * **Channel Coding Theorem:** States that error-free transmission is possible up to a maximum rate (the channel capacity) despite noise, given an efficient coding scheme.
18. **What is a Transmitter and its Purpose?**
    * A transmitter sends information by converting data into an electromagnetic signal, modulating it, and broadcasting it over a communication channel.
19. **Title: 16-QAM BER vs SNR**
    * In 16-QAM (Quadrature Amplitude Modulation), the Bit Error Rate (BER) depends on the Signal-to-Noise Ratio (SNR). As SNR increases, BER decreases, as higher SNR means less noise interfering with signal clarity.
20. **What is BER (Bit Error Rate)?**
    * BER is the ratio of erroneous bits to the total number of bits transmitted, used to measure the accuracy of a communication system.
21. **Formulas for Entropy:**
    * **Shannon Entropy**: H(X)=−∑p(x)log⁡2p(x)*H*(*X*)=−∑*p*(*x*)log2​*p*(*x*)
    * **Conditional Entropy**: H(Y∣X)=−∑p(x,y)log⁡2p(y∣x)*H*(*Y*∣*X*)=−∑*p*(*x*,*y*)log2​*p*(*y*∣*x*)
    * **Joint Entropy**: H(X,Y)=−∑p(x,y)log⁡2p(x,y)*H*(*X*,*Y*)=−∑*p*(*x*,*y*)log2​*p*(*x*,*y*)

**You said:**

DC Viva 1. Full form of ISI , what is ISI? 2. ⁠what is equilizer? 3. ⁠source coding and channel coding 4. ⁠LBC and Cyclic coding 5. ⁠what is random process, autocorrelation , crosscorrelation 6. ⁠FHSS and DSSS basic difference 7. ⁠what is BPSK , Difference between BPSK and BFSK 8. ⁠types of random processes

**ChatGPT said:**

ChatGPT

Here’s a guide to your DC viva questions:

1. **Full Form of ISI, What is ISI?**
   * ISI stands for **Inter-Symbol Interference**. It occurs when overlapping symbols interfere with each other during transmission, typically due to limited bandwidth, multipath propagation, or filtering effects, causing distortion and increased error rates.
2. **What is an Equalizer?**
   * An equalizer is a device or algorithm that compensates for signal distortion caused by ISI. It does this by adjusting the frequency response to improve signal clarity and reduce errors, especially in communication channels with multipath interference.
3. **Source Coding and Channel Coding**
   * **Source Coding**: A process of compressing data to reduce redundancy before transmission, making it more efficient (e.g., Huffman and Shannon-Fano coding).
   * **Channel Coding**: A method to add redundancy to data to detect and correct errors that occur during transmission (e.g., Hamming codes, convolutional codes).
4. **LBC (Linear Block Code) and Cyclic Coding**
   * **LBC**: A coding scheme where each code word is a linear combination of a set of basis vectors. LBCs have the property that any linear combination of code words also results in a valid code word.
   * **Cyclic Code**: A special type of LBC where a cyclic shift of any valid code word is also a valid code word, making it easier to implement with shift registers.
5. **What is a Random Process, Autocorrelation, and Cross-Correlation?**
   * **Random Process**: A collection of random variables that evolve over time, representing unpredictable signals, such as noise.
   * **Autocorrelation**: Measures the similarity between a signal and a time-shifted version of itself, useful for identifying repeating patterns or periodicity.
   * **Cross-Correlation**: Measures the similarity between two different signals as a function of the time delay between them, useful for time alignment and detection tasks.
6. **Basic Difference Between FHSS and DSSS**
   * **FHSS (Frequency Hopping Spread Spectrum)**: Spreads the signal by rapidly changing (or "hopping") between different frequencies in a pseudo-random sequence.
   * **DSSS (Direct Sequence Spread Spectrum)**: Spreads the signal by multiplying it with a high-rate pseudo-random code, dispersing it across a wider frequency band.
7. **What is BPSK? Difference Between BPSK and BFSK**
   * **BPSK (Binary Phase Shift Keying)**: A modulation scheme that uses two phases (0° and 180°) to represent binary ‘0’ and ‘1’, making it phase-based.
   * **Difference**: BPSK is phase-based with only two possible phases, while BFSK (Binary Frequency Shift Keying) uses two different frequencies to represent binary '0' and '1'. BPSK typically provides better spectral efficiency, whereas BFSK offers better frequency separation.
8. **Types of Random Processes**
   * **Stationary Process**: The statistical properties (mean, variance) do not change over time.
   * **Non-Stationary Process**: Statistical properties vary with time.
   * **Ergodic Process**: A process where time averages equal ensemble averages, allowing statistical analysis over time.
   * **Markov Process**: A process where the future state depends only on the present state and not on past states.
   * **Gaussian Process**: Every finite set of samples has a joint Gaussian distribution.
   * **White Noise Process**: A random process with equal power across all frequencies and no correlation between values at different times.