1. Which mathematical tool is used to represent a signal in the frequency domain?

a) Laplace transform
b) Fourier transform
c) Z-transform
d) Hankel transform

Answer: b) Fourier transform
Explanation: The Fourier transform is a mathematical tool used to represent a signal in the frequency domain by decomposing it into its constituent frequencies.

2. What is the condition for the existence of the Fourier transform of a signal?

a) The signal must be bounded
b) The signal must be continuous
c) The signal must be absolutely integrable
d) The signal must be periodic

Answer: c) The signal must be absolutely integrable
Explanation: The Fourier transform exists for signals that are absolutely integrable, meaning the integral of the signal's magnitude over its entire domain is finite.

3. What is the Fourier transform of an impulse function?

a) Zero
b) Dirac delta function
c) Unity
d) Infinity

Answer: b) Dirac delta function
Explanation: The Fourier transform of an impulse function is a Dirac delta function, which is a mathematical construct representing an infinitely high spike at the origin and zero elsewhere.

4. Which signal yields a constant Fourier transform?

a) Impulse
b) Step
c) Cosine
d) Sine

Answer: a) Impulse
Explanation: The Fourier transform of an impulse function is constant, meaning it does not vary with frequency.

5. What property of the Fourier transform relates to the convolution operation in the time domain?

a) Linearity
b) Time-shifting
c) Convolution theorem
d) Duality

Answer: c) Convolution theorem
Explanation: The convolution theorem states that convolution in the time domain corresponds to multiplication in the frequency domain, and vice versa.

6. What is the Fourier transform of a step function?

a) Dirac delta function
b) Sine function
c) Cosine function
d) sinc function

Answer: d) sinc function
Explanation: The Fourier transform of a step function is a sinc function, which is defined as the sine of a normalized frequency divided by the frequency.

7. What property of the Fourier transform is utilized to analyze the frequency content of a signal?

a) Time-scaling
b) Frequency-shifting
c) Convolution
d) Energy spectral density

Answer: d) Energy spectral density
Explanation: The energy spectral density, obtained from the Fourier transform, provides information about the distribution of a signal’s energy across different frequencies.

8. Which property of the impulse function allows it to act as a sampling function in signal processing?

a) Time-scaling
b) Time-shifting
c) Time-reversal
d) Time-averaging

Answer: b) Time-shifting
Explanation: The impulse function can be shifted along the time axis to sample a signal at different instants, making it a fundamental tool in signal processing and sampling theory.

9. What operation in the time domain corresponds to multiplication in the frequency domain, according to the convolution theorem?

a) Addition
b) Convolution
c) Differentiation
d) Integration

Answer: b) Convolution
Explanation: According to the convolution theorem, convolution in the time domain corresponds to multiplication in the frequency domain, and vice versa.

10. What is the Fourier transform of a cosine function?

a) Sine function
b) Dirac delta function
c) Impulse function
d) Gaussian function

Answer: d) Gaussian function
Explanation: The Fourier transform of a cosine function is a Gaussian function, which represents a bell-shaped curve in the frequency domain.

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