Summary of Important Concepts

1. A periodic discrete time signal with a fundamental period N can be decomposed into N harmonically related frequency components.
2. The Fourier series representation can be obtained only for periodic discrete time signals.
3. The Fourier transform technique can be applied to both periodic and nonperiodic discrete time signals.
4. The Fourier coefficients of periodic discrete time signal with period N is also periodic with period N.
5. The Fourier coefficient c_k represents the amplitude and phase associated with the k^{th} frequency component.
6. The frequency range of discrete time signal is 0 to 2π (or $-\pi$ to $+\pi$) and so it has finite frequency spectrum.
7. The plot of harmonic magnitude / phase of a discrete time signal versus "k" (or harmonic frequency ω_k) is called Frequency spectrum.
8. The plot of harmonic magnitude versus "k" (or ω_k) is called magnitude spectrum.
9. The plot of harmonic phase versus "k" (or ω_k) is called phase spectrum.
10. The sequence $|c_k|^2$ for $k = 0, 1, 2, ..., (N-1)$ is called the power density spectrum (or) power spectral density of the periodic signal.
11. The Fourier transform is also called analysis of discrete time signal x(n).
12. The inverse Fourier transform is also called synthesis of discrete time signal x(n).
13. The Fourier transform exists only for the discrete time signals that are absolutely summable,
14. The Fourier transform of a signal is also called signal spectrum.
15. The Fourier transform of a discrete time signal is periodic with period 2π.
16. The Fourier transform of any periodic discrete time signal consists of train of impulses located at harmonic frequencies of the signal..
17. The ratio of Fourier transform of output and input of an LTI discrete time system is called transfer function of the LTI discrete time system in frequency domain.
18. The frequency domain transfer function is also given by Fourier transform of impulse response.
19. The Fourier transform of impulse response is called frequency response of the system.
20. The frequency response of discrete time system is periodic continuous function of ω with period 2π.
21. The first order discrete time system behaves as either lowpass filter or highpass filter .
22. The second order system behaves as a resonant filter (or bandpass filter).

TWO MARKS QUESTIONS AND ANSWERS

1. Define DTFT.

Let us consider the discrete time signal x(n).Its DTFT is denoted as X(w).It is given as $X(w)= x(n)e^{-jwn}$

2. State the condition for existence ofDTFT? The conditions are

- If x(n)is absolutely summable then $|x(n)|<\infty$
- If x(n) is not absolutely summable then it should have finite energy for DTFT to exit.

3. What is the DTFT of unit sample?

The DTFT of unit sample is 1 for all values of w.

4. Define DFT.

DFT is defined as X(w)= x(n)e^{-jwn}. Here x(n) is the discrete time sequence X(w) is the fourier transform of x(n).

5. Define Z transform.

The Z transform of a discrete time signal x(n) is denoted by X(z) and is given by X(z)= x(n)Z^{-n}.

6. Define ROC.

The value of Z for which the Z transform converged is called region of convergence.

7. Find Z transform of x(n)={1,2,3,4} x(n)= {1,2,3,4}

X(z)= x(n)z^{-n}

= 1+2z^{-1}+3z^{-2}+4z^{-3}. = 1+2/z+3/z2+4/z3.

8.State the convolution property of Z transform.

The convolution property states that the convolution of two sequences in time domain is equivalent to multiplication of their Z transforms.

9.What z transform of (n-m)?

By time shifting property

Z[A (n-m)]=AZ^{-m} sinZ[(n)] =1

10.State initial value theorem.

If x(n) is causal sequence then its initial value is given by

x(0)=lim X(z)

11.List the methods of obtaining inverse Z transform.

Inverse z transform can be obtained by using

_ Partial fraction expansion.
_ Contour integration
_ Power seriesexpansion
_ Convolution.

12.Obtain the inverse z transform of X(z)=1/z-a,|z|>|a| Given X(z)=z-1/1-az-1

By time shifting property

X(n)=an.u(n-1)