A block diagram represents the system as an interconnection of elementary operations on signals. The manner in which these operations are interconnected defines the internal structure of the system. Different block diagrams can represent systems with identical input–output characteristics.

The state-variable description is yet another description of LTI systems that is used in controlling such systems and in advanced studies of structures for implementing difference equations. The state-variable description consists of a set of coupled first-order differential or difference equations representing the system's behavior. Written in matrix form, the description consists of two equations, one describing how the state of the system evolves, the other relating the state to the output. The state represents the system's entire memory of the past. The number of states corresponds to the number of energy storage devices or the maximum memory of past outputs present in the system. The choice of state is not unique: An infinite number of different state-variable descriptions can be used to represent LTI systems with the same input–output characteristic. Thus, state-variable descriptions are used to represent the internal structure of a physical system and provide a more detailed characterization of LTI systems than the impulse response or differential (difference) equations can.

TWO MARKS QUESTIONS AND ANSWERS

1. **Define LTI-CT systems**.

In a continuous time system if the time shift in the input signal results in the corresponding time shift in the output, then it is called the LTI-CT system

2. What are the tools used for analysis of LTI-CT systems?

The tools used for the analysis of the LTI-CT system are

Fourier transform

Laplace transform

3.Define convolution integral.

The convolution of of two signals is given by $y(t)= x(t)*h(t)$

where

$x(t)*h(t)= \quad x(t)h(t-\tau).dt$

This is known as convolution integral.

4.List the properties of convolution integral

a. commutative property
b. distributive property
c. associative property
d. shift property
e. convolution with an impulse
f. width property

5.State commutative property of convolution.

The commutative property of convolution states that $x_1(t)*x_2(t)=x_2(t)*x_1(t)$

6.State the associative property of convolution.

Associative property of convolution states that $x_1(t)*[x_2(t)*x_3(t)]=[x_1(t)*x_2(t)]*x_3$

7.State distributive property of convolution.

The distributive property states that

$x_1(t)*[x_2(t)+x_3(t)]=x_1(t)*x_2(t)+x_1(t)*x_3(t)$

8**. When the LTI-CT system is said to be dynamic?**

In LTI CT system, the system is said to be dynamic if the present output depends only on the present input.

9. **When the LTI-CT system is said to be causal?**

An LTI continuous time system is causal if and only if its impulse response is zero for negative values of t.

10. **When the LTI-CT system is said to be stable?**

A LTI-CT system is said to be stable if the impulse response of the system is absolutely integrable.

11. **Define natural response.**

Natural response is the response of the system with zero input. It depends on the initial state of the system. It is denoted by $y_n(t)$

12. Define forced response.

Forced response is the response of the system due to input alone when the initial state of the system is zero. It is denoted by $y_f(t)$.

13**. Define complete response.**

The complete response of a LTI-CT system is obtained by adding the natural response and forced response.

$y(t)= y_n(t)+ y_f(t)$

14.Mention the advantages of direct form II structure over direct form I structure.

No.of integrators are reduced to half

15. **Define Eigen function and Eigen value.**

In the equation given below,

y(t)=H(s)est

H(s) is called Eigen value and est is called Eigen function.

16. **Define Causality and stability using poles**.

For a system to be stable and causal, all the poles must be located in the left half of the s plane

17. **Find the impulse response of the system y(t)=x(t-t0) using laplace transform**.

Ans:

h(s)= d(t-t0)

18**. The impulse response of the LTI CT system is given as h(t)=e-t u(t). Determine transfer function and check whether the system is causal and stable.**

Ans:

H(s)=1/(s+1)

The system is causal,stable.