# GGS COLLEGE OF MOREN TECHNOLOGY, KHARAR

## DEPTT. OF ELECTRONICS & COMMUNICATION ENGG.

# Question Bank

# Signal & Systems (BTEC-403-18)

1. **Define Signal.**
   Signal is a physical quantity that varies with respect to time, space or any other independent variable. (or) A signal is a function of one or more independent variables which contain some information.
   Eg: Radio signal, TV signal, Telephone signal etc.

2. **Define System.**
   A system is a set of elements or functional block that are connected together and produces an output in response to an input signal. Eg: An audio amplifier, attenuator, TV set etc.

3. **Define CT signals.**
   Continuous time signals are defined for all values of time. It is also called as an analog signal and is represented by x(t). Eg: AC waveform, ECG etc.

4. **Define DT signal.**
   Discrete time signals are defined at discrete instances of time. It is represented by x(n). Eg: Amount deposited in a bank per month.

5. **Give few examples for CT signals.**
   AC waveform, ECG, Temperature recorded over an interval of time etc.

6. **Define unit step, ramp and delta functions for CT.**
   Unit step function is defined as

   $$U(t) = 1 \text{ for } t >= 0$$
   $$0 \text{ otherwise}$$

   Unit ramp function is defined as

   $$r(t) = t \text{ for } t>=0$$
   $$0 \text{ for } t<0$$

   Unit delta function is defined as

   $$\delta(t)= 1 \text{ for } t=0$$
   $$0 \text{ otherwise}$$

**7. State the relation between step, ramp and delta functions (CT).**

The relationship between unit step and unit delta function is

$$\delta(t) = u(t)$$

The relationship between delta and unit ramp function is

$$\delta(t).dt = r(t)$$

**8. State the classification of CT signals.**

The CT signals are classified as follows

(i) Periodic and non periodic signals

(ii) Even and odd signals

(iii) Energy and power signals

(iv) Deterministic and random signals

**9. Define deterministic and random signals.**

A deterministic signal is one which can be completely represented by mathematical equation at any time. In a deterministic signal there is no uncertainty with respect to its value at any time.

Eg: $x(t)=\cos wt$

$x(n)=2wft$

A random signal is one which cannot be represented by any mathematical equation. Eg: Noise generated in electronic components, transmission channels, cables etc.

**10. Define Random signal.**

There is no uncertainty about the deterministic signal. It is completely represented by mathematical expression.

**11. Define power and energy signals.**

The signal x(t) is said to be power signal, if and only if the normalized average power p is finite and non-zero.

$$\text{ie. } 0<p<E<\infty$$

A signal x(t) is said to be energy signal if and only if the total normalized energy is finite and non-zero.

$$\text{ie. } 0<E<\infty$$

**12. Define odd and even signal.**

A DT signal x(n) is said to be an even signal if $x(-n) = x(n)$ and an odd signal if $x(-n)=-x(n)$.

A CT signal is x(t) is said to be an even signal if $x(t)=x(-t)$ and an odd signal if $x(-t) = -x(t)$.

**13. Define periodic and aperiodic signals.**

• A signal is said to be periodic signal if it repeats at equal intervals.
• Aperiodic signals do not repeat at regular intervals.
• A CT signal which satisfies the equation x(t) = x(t+T0) is said to be periodic and a DT signal which satisfies the equation x(n) = x(n+N) is said to be periodic.

**14. State the classification or characteristics of CT and DT systems.**

The DT and CT systems are according to their characteristics as follows
(i). Linear and Non-Linear systems
(ii). Time invariant and Time varying systems.
(iii). Causal and Non causal systems.
(iv). Stable and unstable systems.
(v). Static and dynamic systems.
(vi). Inverse systems.

**15. Define linear and non-linear systems.**

A system is said to be linear if superposition theorem applies to that system. If it does not satisfy the superposition theorem, then it is said to be a nonlinear system.

**16. Define time invariant and time varying systems.**

A system is time invariant if the time shift in the input signal results in corresponding time shift in the output. A system which does not satisfy the above condition is time variant system.

**17. Define stable and unstable systems.**

When the system produces bounded output for bounded input, then the system is called bounded input, bounded output stable. A system which does not satisfy the above condition is called a unstable system.

**18. Define Static and Dynamic system.**

A system is said to be static or memory less if its output depends upon the present input only. The system is said to be dynamic with memory if its output depends upon the present and past input values.

**19. Define power signal.**

A signal is said to be power signal if its normalized power is nonzero and finite.
i.e., $0 < P < \infty$ 30.

**20. Define signal. What are classifications of signals?**

A function of one or more independent variables which contain some information is called signal.

**21. List some properties of continuous-time Fourier transform.**

1. Linearity

2. Time reversal
3. Time scaling
4. Conjugation
5. Parseval's relation
6. Differentiation
7. Integration
8. Convolution
9. Multiplication

**22. Define sampling process.**

Sampling is a process of converting CT signal into DT signal.

**23. Mention the types of sampling.**

- Up sampling
- Down sampling

**24. What is meant by quantizer?**

It is a process of converting discrete time continuous amplitude into discrete time discrete amplitude.

**25. List out the types of quantization process.**

- Truncation
- Rounding
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**26. Define truncation.**

Truncating the sequence by multiplying with window function to get the finite value.

**27. What is rounding?**

In this we consider the nearest value.

**28. State sampling theorem.**

The sampling frequency must be atleast twice the maximum frequency present in the signal.
That is $Fs \geq 2fm$
Where, Fs = sampling frequency
Fm = maximum frequency

**29. Define nyquist rate.**

It is the minimum rate at which a signal can be sampled and still reconstructed from its samples.
Nyquist rate is always equal to 2fm.

**30. Define aliasing or folding.**

The superimposition of high frequency behaviour on to the low frequency behaviour is referred as aliasing. This effect is also referred as folding.

**31. What is the condition for avoid the aliasing effect?**

To avoid the aliasing effect the sampling frequency must be twice the maximum frequency present in the signal.

**32. Define z transform?**

The Z transform of a discrete time signal x(n) is defined as,

$X(Z) = \sum_{n=-\infty}^{\infty} x(n)\, z^{-n}$

Where, z is a complex variable. In polar form $z=re^{-j\omega}$.

**33. What is meant by ROC?**

The region of convergence (ROC) is defined as the set of all values of z for which X(z) converges.

**34. What are the properties of ROC?**

a. The roc is a ring or disk in the z plane centered at the origin.

b. The roc cannot contain any pole.

c. The roc must be a connected region

d. The roc of an LTI stable system contains the unit circle.

**35. Define zeros.**

The zeros of the system H(z) are the values of z for which H(z) = 0.

**36. Define poles.**

The poles of the system H(z) are the values of z for which H(z) = α.