ST. ANNE'S

COLLEGE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, New Delhi. Affiliated to Anna University, Chennai)
(An ISO 9001: 2015 Certified Institution)
ANGUCHETTYPALAYAM, PANRUTI – 607 106.

QUESTION BANK

PERIOD : JUN 2019 – DEC 2019 **BATCH**:2018-2022

BRANCH : ECE **YEAR/SEM:**II/III

SUBJECT: EC8352-Signals And Systems

UNIT – I – CLASSIFICATION OF SIGNALS AND SYSTEMS

PART – A

1. Define Signal.[D]

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. [D]

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. [D]

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. [D]

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. [D]

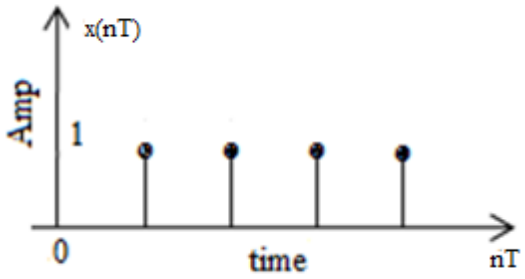
AC waveform, ECG, Temperature recorded over an interval of time etc.

6. Give few examples of DT signals. [D]

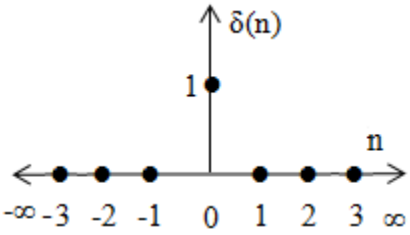
Amount deposited in a bank per month,

7. Define unit step, ramp and delta functions for CT. [D]

Unit step function is defined as
U(t)= 1 for t >= 0
0 otherwise



Unit ramp function is defined as
r(t)= t for t>=0
0 for t<0
Unit delta function is defined as
δ(t)= 1 for t=0
0 otherwise



8. State the relation between step, ramp and delta functions (CT). [D]

The relation ship between unit step and unit delta function is
δ(t)= u(t)
The relationship between delta and unit ramp function is
δ(t).dt = r(t)

9. State the classification of CT signals. [D]

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.

10. Define deterministic and random signals. [May/ June 2013] [D]

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: $x(t)=\cos\omega t$
$x(n)=2\pi fn$
A random signal is one which cannot be represented by any mathematical equation.
Eg: Noise generated in electronic components, transmission channels, cables etc.

11. Define power and energy signals. [Apr/May 2013] [D]

The signal x(t) is said to be power signal, if and only if the normalized average power p is finite and non-zero.
Ie. $0<p<4$
A signal x(t) is said to be energy signal if and only if the total normalized energy is finite and non-zero.
Ie. $0<E< 4$

12. Compare power and energy signals. [D]

S.NO	POWER SIGNAL	ENERGY SIGNAL
1	The normalized average power is finite and non-zero	Total normalized energy is finite and non- zero.
2	Practical periodic signals are power signals	Non-periodic signals are energy signals

13. Define odd and even signal. [D]

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 $x(-t)=-x(t)$.

14. Define periodic and aperiodic signals. [D]

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.

15. State the classification or characteristics of CT and DT systems. [D]

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.

16. Define linear and non-linear systems. [D]

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.

17. Define Causal and non-Causal systems. [D]

A system is said to be a causal if its output at anytime depends upon present and past inputs only.
A system is said to be non-causal system if its output depends upon future inputs also.

18. Define time invariant and time varying systems. [D]

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.

19. Define stable and unstable systems. [D]

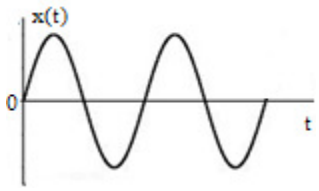
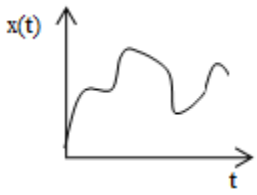
When the system produces bounded output for bounded input, then the system is called bounded input, bounded output stable.
A system which doesnot satisfy the above condition is called a unstable system.

20. Define Static and Dynamic system. [D]

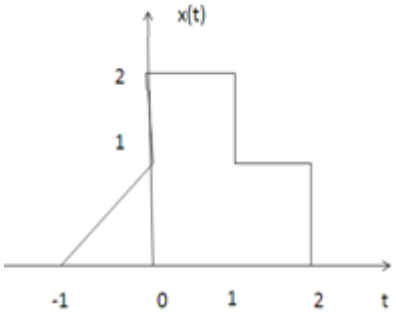
A system is said to be static or memoryless if its output depends upon the present input only.
The system is said to be dynamic with memory if its output depends upon the present and past input values.

21. Difference between Periodic and Aperiodic signals. (Apr/May 2010)[D]

S.NO	PERIODIC SIGNAL	NON PERIODIC
1	For CT signal is said to be periodic if, $x(t) = x(t+T)$ for all t.	For CT signal is said to be A periodic If, $x(t) \neq x(t+T)$ for all t.
2	For Discrete, if, $x(n) = x(n+N)$ for all n.	For Discrete, If, $x(n) \neq x(n+N)$ for all n.

3		

22. For the signal shown in Figure, find x(2t + 3) . Nov/Dec 2009 May 2014[I]
Solution:



Starting point	Ending point
2t+3 = -1	2t+3 = 2
2t = -4	2t = -1
t= -2	t = -0.5

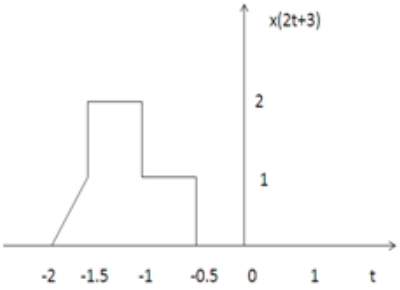


Fig : x(2t+3)

23. Check whether the following system is static or dynamic and also causal and noncausal.

y(n) =x(2n) (Nov/Dec 2012, Apr/May 2010)[I]

A System is said to be **static (Memory less)**, if its output depends upon the present input only. A System is said to be **dynamic (System with Memory)**, if its output depends upon post as well as future values of the input.

(i) The given system equation is,
y(n) = x(2n)
Here when, n = 1_ y(1) = x(2)

n = 2_ y(2) = x(4)…
Thus the output y(n) depends upon the future inputs. Hence the system is **non-causal**.

(ii) The given system equation is,
y(n) = x(2n)
Here when, n = 1_ y(1) = x(2)
n = 2_ y(2) = x(4)…
Thus the system needs to store the future input samples. It requires memory. Hence the system is **dynamic.**

24. Determine whether the system y(n) = log(1+|x(n)|) is stable or not. (Nov/Dec 2011) [D]
Here y(n) = log(1+|x(n)|) is taken.This means 1+ |x(n)| > 0.
Hence y(n) will be bounded for all bounded values of x(n).
The system is **stable**.

25. **Verify whether the system described by the equation is linear and time invariant y(t) = x(t2). (Apr/May 2012)[ID]**
Solution:
Condition for linearity
a1y1(t) + a2y2(t) = f [a1x1(t) + a2x2(t)]
y1(t) = x1(t2)
y2(t) = x2(t2)
a1y1(t) = a1x1(t2)
a2y2(t) = a2x2(t2)
a1y1(t) + a2y2(t) = a1x1(t2) + a2x2(t2)
= [a1x1(t2) + a2x2(t2)] _(1)
R.H.S
f[a1x1(t) + a2x2(t)] = [a1x1(t2) + a2x2(t2)] _(2)
(1) = (2) Therefore the system is **linear.**
Condition for Time Invariant
y(t-T) = F [x(t-T)]
y(t-T) = x(t-T)2_(1)
F[x(t-T)] = x(t2-T) _(2)
(1) ≠ (2)
Therefore the system is **time variant**

26. Sketch the following signals. (**May/Jun 2014)[ID]**
a) x(t) = 2t for all t
b) x(n) = 2n – 3, for all n.
Solution:
a) x(t) = 2t for all t

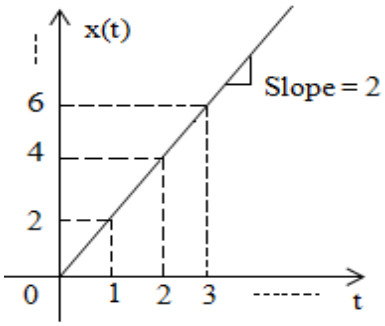


Fig: x(t) = 2t

t = 0, x(t) = 0
t = 1, x(t) = 2
t = 2, x(t) = 4

b) x(n) = 2n – 3, for all n.
n = -2, x(n) = -7
n = -1, x(n) = -5
n = 0, x(n) = -3
n = 1, x(n) = -1
n = 2, x(n) = 1
n = 3, x(n) = 3
n = 4, x(n) = 5
n = 5, x(n) = 7

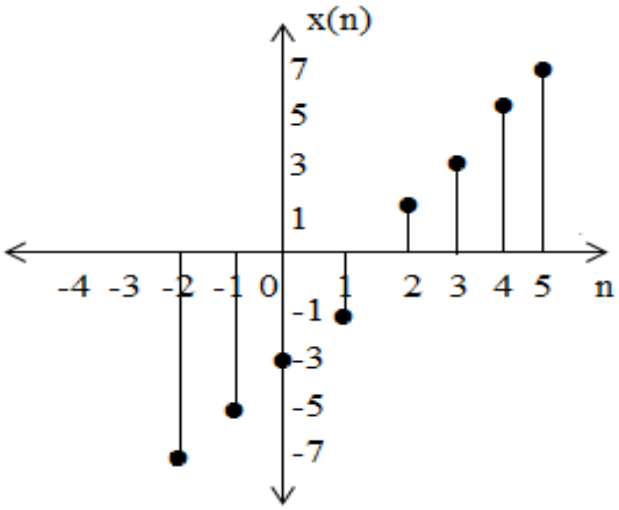


Fig: x(n) = 2n – 3

27. Check whether the discrete time signal sin3n is periodic. (May/Jun 2013)[ID]
Solution:
x(n) = sin3n
$2\pi f=3$

f=3/2π

The number is the irrational number. Hence the given signal is non-periodic.

28. Define Time Invariant and Variant System (or) what are the condition for a system to be LTI system ?
(or) How do you prove that the system is time invariant?(Nov/Dec 2019) [D]
• A System is said to be time-invariant, if its input-output characteristics do not change with time.
• A System is said to be linear time Invariant system, if it satisfies the condition.
For CT System, y(t-T) = f [x(t-T)]
For DT System, y(n-K) = f [x(n-K)]
• If it does not satisfies the condition the given system is “Time variant system".
NOTE:
• If all Coefficients are constant, the given system is Linear Time System.
Eg: 2d2y(t)/dt2 + 4dy(t)/dt + 5y(t) = 5x(t)
• If coefficient is a function of time the given system is "Linear Time Varying System".
Eg: 2d2y(t)/dt2 + 4tdy(t)/dt + 5y(t) = x(t).

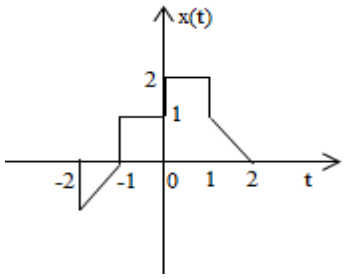
29.Determine whether the signal x(t) = cos (π/2) t is periodic or not. Also find its period if it is periodic. [D][Apr/May-2017]
Solution :
2πf=π/2
F=1/4
The signal is periodic.

30.Check for periodicity of cos (0.01 πn) [Apr/may 2019] [ID]
Solution:
2πf=π0.01
F=0.01/2
F=0.005
Hence the signal is periodic.

31. Determine whether the given discrete time signal is periodic or not?
x[n]= cos(n/8)cos(πn/8)**[Apr/may 2019][ID]**
2πf1=1/8
f1=1/16π.
2πf2=π/8
f2=1/16
it’s a non periodic system
32. Find whether the described system y[n]=nx[n] is time invariant or not)[Apr/may 2019]
It is a time invariant system

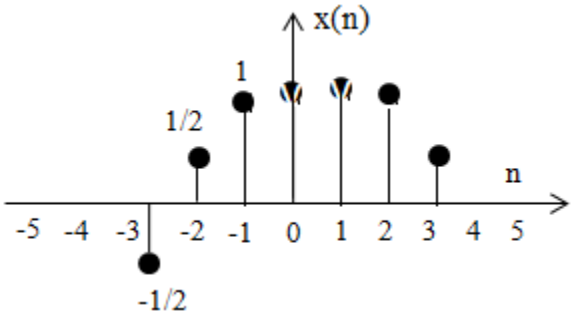
PART – B

1. A continuous time signal x(t) is shown in fig. sketch and label carefully each of the following signal: 1) x(t-1) 2) x(2-t) 3)x(t)[δ(t+3/2) - δ(t-3/2)] 4) x(2t+1) **[Nov/Dec 2015] [Apr/may 2019][ID]**



2. Sketch the following signals:(**Apr/May2011)[ID]**
1) x(t) = r(t) 2) x(t) = r(-t+2) 3) x(t) = -2r(t)

3. A discrete time signal is shown below: Sketch the following **(Nov/Dec 2016) [ID]**
1) x(n-3) 2) x(3-n) 3) x(2n)



4. CLASSIFICATION OF CT SIGNALS & DT SIGNALS

Check whether the following are periodic (**May/Jun 2011) [ID]**
1) x(n) = sin(6π/7 n+1)

5. Check whether the following signals are periodic/aperiodic signals.
x(n) = 3 + cos(π/2n)+ cos2n**[Nov/ Dec 13, 14] [ID]**

6. POWER/ENERGY:[D]
a) Define energy & power signals. Find whether the signals x(n) =(1/2)n u(n)is energy or power signals and calculate their energy and power

7. SYSTEM CLASSIFICATION[D]

1)d/d1 y(t) + ty(t) = x(t)
a) Linear (or) non linear

8. y(n) = x2(n). Calculate the different types of systems**[APRIL/MAY 09, NOV 12] [ID]**

9. y(t) =x(n)+nx(n+1). Classify the systems**[ID]**

10.Write about elementary Continuous time Signals in Detail. **[ID]**

Determine the power and RMS value of the following signals.
(t) = 5cos $(50t + \pi/3)$
$(t) = 10cos5tcos10t$

11. Determine whether the following system are time invariant or not. **[ID]**
$y(t) = tx(t)$
$(n) = (2n)$

12. Distinguish between the following. **[ID]**

1.Continuous time signal and discrete time signal
2. Unit step and Unit Ramp functions.
3.Periodic and Aperiodic Signals.
4. Deterministic and Random Signals.

13. Check the following for linearity, time invariance, causality and Stability.

$(n) = (n) + (n + 1)$ 8. **[ID]**

14. A Discrete time System is given as y(n) = y2(n-1) = x(n). A bounded input of $(n) = 2(n)$ is applied to the system. Assume that the system is initially relaxed. Check whether the system is stable or unstable. **[ID]**

15. Determine the whether the systems described the i/p o/p equations are linear, time invariant, dynamic and stable. **[ID]**
i. $y1(t) = x(t - 3) + (3 - t)$
ii. dx(t)/dt
iii. $y1[n] = nx[n] + bx2[n]$

16. i. Find whether the following signal **[D]**
(t) = 2 cos$(10t + 1) -$ sin $(4t - 1)$ is periodic or not

Explain the properties of unit impulse function.
Find the fundamental period T of the continuous time signal.
$(t) = 20\cos(10\pi t + \pi/6)$

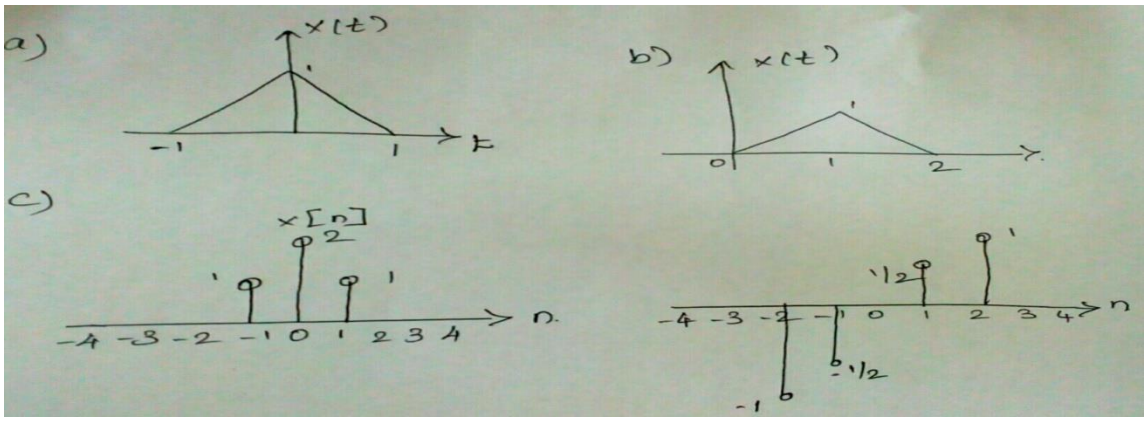
17.Check the signal is periodic or non-periodic[Apr/may 2019][D]
X(n)=cos(πn/5)sin(πn/3)
X(t)=cos(2t)+sin(t/5)

18.Find out whether the following signals are periodic or not. If periodic find the period
X (t) = 2 cos (l0t + 1) - sin (4t -1), x (n) =cos (0.1πn). (8) **[Apr/May-2017] [ID]**

19.Find out whether the following signals are energy or power signal or neither power nor energy as the case may be for the signal. X (t) = u (t) +5 u (t-1) – 2u (t-2) (7)**[Apr/May-2017] [ID]**

20Find the whether the signal is an energy signal or power signal. **[ID]**

i) X (t) = e^{-2t} u (t). (5)
ii) Draw the waveform for the signal x(t) = r(t) - 2r(t -1) + r(t - 2). (4)
iii) For the given signal determine whether it is even, odd, or neither



21.Sketch i) x (t) ii) x(t+1) iii) x(2t) iv) x(t/2) for following signal: given
x(t) = 1/6(t+2), -2 ≤ t ≤4

0, otherwise (7) **[D][May/Jun-2014].**

22.Determine whether the discrete time sequence is periodic or not.
X(n) = sin [(3π/7) n + π/4] + cos (π/3)n (6) **[D][May/Jun-2014].**

23.Determine whether the signals x (t) = sin 20πt + sin 5πt is periodic and if it is periodic find the fundamental period? **(7)** **[D][Nov/Dec-2013]**

24.Define energy and power signals. Find whether the signal $x(n)=(\frac{1}{2})^n u(n)$ is energy or power signal and calculate their energy and power. **(6) [D][Nov/Dec-2013]**

25.Discuss various forms of real and complex exponential signals with graphical representation.**(6) [D][Nov/Dec-2013]**

26.Define energy and power signals? **(4) [D][May/Jun-2013].**

27.Determine whether the following signal are energy and power and calculate their power and energy i) $x(n)=(\frac{1}{2})^n u(n)$ ii) $x(n) = \text{rect}(t/T_0)$ iii) $x(n) = \cos^2(\omega_0 n)$. **(7) [ID][May/Jun-2013].**

28.Define unit step, ramp, pulse, impulse and exponential signals. Obtain the relationship between unit step and unit ramp function. **(7) [ID][May/Jun-2013].**

29.How are the signals classified? Explain? **(7) [D][Nov/Dec-2012]**

30.Give the equations and draw the waveforms of discrete time real and complex exponential signals.**(6) [D]**

31.Explain all classification DT signals with example for each category. **(7) [D][Nov/Dec-2011]**

32.If x(n)={0,2,-1,0, 2 , 1,1,0,-1} what is x(n-3) and x(1-n) **(7) [D][Nov/Dec-2010]**
⇧

33.Determine the properties viz linearity, causality, time invariance and dynamicity of the given systems

i) $y(t) = d^2y/dt^2 + 3tdy/dt + y(t) = x(t)$

ii) $y_1(n) = x(n^2) + x(n)$

iii) $y_2(n) = \log_{10} x(n)$ **(13) [D][Apr/May-2017]**

34.Determine whether the following system is Liner and Causal. i) $y(n) = x(n).\ x(n-1)$ and

$y(n) = (1/3)[x(n-1)+ x(n) + x(n+1)]$ (5)

35.For x() indicate in figure sketch the following:

a) $X(1-t)[u(t+1) - u(t-2)]$ (4)

b) $X(1-t)[u(t+1) - u(2-3t)]$ (4) **[ID][Nov/Dec-2017]**

36. Find whether the following systems are time variant or fixed. Also find whether the systems are linear or nonlinear : i) $d^3y(t)/dt^3 + 4\,d^2y(t)/dt^2 + 5\,dy/dt + y^2t = x(t)$

ii) $y(n) = an^2\,x(n) + bn\,x(n-2)$ (13) **[D] [May/Jun-2016]**

37.Sketch the following signals:

1)u (-t+2)
2)r(-t+3)
3)2δ[n+2] + δ[n]-2δ[n-1]+3 δ[n-3
4)u[n+2]] u [-n+3]
where u(t), r(t) , g[n], u[n] represent continuous time unit step, continuous time ramp, discrete time impulse and discrete time step functions respectively. (13) **[D][Nov/Dec-2016].**

38.Check the following systems are linear, stable i) $y(t) = e^{x(t)}$ ii) $y(n) = x(n-1)$ (13) **[D][May/Jun-2014].**
Determine whether the discrete time system $y(n) = \cos(\omega n)$ is i) memory less ii) stable iii) causal iv) linear v) time invariant. **(7) [D][Nov/Dec- 2013].**

39.Define LTI system. List the properties of LTI system. Explain? **(7)[D][Nov/Dec- 2017].**

40.Determine whether the systems described by the following input – output equations are linear, dynamic, causal and time variant: i) $y_1(t) = x(t-3) + (3-t)$ ii) $y_2(t) = dx(t)/dt$ iii) $y_1(n) = n\,x[n] + b\,x_2[n]$ iv) even {x[n-1]}. **(7)[D][May/Jun- 2018].**

41.A discrete time system is given as $y(n) = y^2(n-1) = x(n)$. A bounded input of $x(n) = 2\,\delta(n)$ is applied to the system. Assume that the system is initially relaxed. Check whether system is stable or unstable. **(7)[D][May/Jun- 2018].**

42. Determine the energy and power of the given signal
x[n]=cos[(π/4)n] **[Apr/may 2019][D]**

43. Check the given system is
Linear/non linear
Time invariant/time variant
Causal/Non-causal
y[n]=x[n]-x[n-1] **[Apr/may 2019][D]**