Signals and Systems

1) The period of signal x(t) = 24 + 50 cos60 πt is

(a) $\frac{1}{30}$ S (b) 60 π S (c) $\frac{1}{60\pi}$ S (d) Not Periodic

= Answer (a) $\frac{1}{30}$ S

$\frac{2\pi}{T}$ = 60 π

=>T = $\frac{2\pi}{60\pi}$

∴ T = $\frac{1}{30}$

2) The period of signal x(t) = 10 sin 5t – 4 cos 9t is

(a) $\frac{24\pi}{35}$ (b) $\frac{4\pi}{35}$ (c) 2π (d) Not periodic

= Answer (c) 2π

$\frac{2\pi}{T_1}$ = 5

∴ T_1 = $\frac{2\pi}{5}$

$\frac{2\pi}{T_2}$ = 9

∴ T_2 = $\frac{2\pi}{9}$

LCM ($\frac{2\pi}{5}$, $\frac{2\pi}{9}$)

= 2π

3) The period of signal x(t) = 5t – 2 cos 6000πt is

(a) 0.96 S (b) 1.4 ms (c) 0.4 ms (d) Not periodic

= Answer (d) Not periodic

Not periodic because of t.

4) The period of signal x(t) = 4 sin 6t + 3 sin $\sqrt{3}$ t is

(a) $\frac{2\pi}{3}$ S (b) $\frac{2\pi}{\sqrt{3}}$ S (c) 2π (d) Not periodic

= Answer (d) Not periodic

5) The signal x(t) = e^{-4t} u(t) is a

(a) power signal with $P_\infty = \frac{1}{4}$

(b) power signal with $P_\infty = 0$

(c) energy signal with $E_\infty = \frac{1}{4}$

(d) energy signal with $E_\infty = 0$

= Answer (c) energy signal with $E_\infty = \frac{1}{4}$

$E_\infty = \int_{-\infty}^{\infty} |x(t)|^2 dt$

$= \int_{-\infty}^{\infty} e^{-4t} u(t)\, dt$

$= \int_{0}^{\infty} e^{-4t}\, dt$

Let,

$e^{-4t} = z$

$\Rightarrow \frac{d}{dt}(e^{-4t}) = \frac{dz}{dt}$

$\Rightarrow e^{-4t}.(-4) = \frac{dz}{dt}$

$\therefore e^{-4t}.dt = -\frac{1}{4} dz$ ……(I)

$= \int_{0}^{\infty} e^{-4t}.dt$

$= \int_{0}^{\infty} -\frac{1}{4} dz$ [From (I)]

$= \left[-\frac{1}{4} z\right]_0^\infty$

$= \left[-\frac{1}{4} e^{-4t}\right]_0^\infty$

$= -\frac{1}{4} e^{-4(\infty)} + \frac{1}{4} e^{-4(0)}$

= $\frac{1}{4}$

6) u$[n]$ + u$[-n]$ is aqual to

(a) 2 (b) 1 + $\delta[n]$ (c) 2 + $\delta[n]$ (d) 1

= Answer (b) 1 + $\delta[n]$

7) The Laplace transform of signal u(t-2) is

(a) $\frac{-e^{-2s}}{s}$ (b) $\frac{e^{-2s}}{s}$ (c) $\frac{e^{-2s}}{1+s}$ (d) zero

= Answer (b) $\frac{e^{-2s}}{s}$

X(s) = $\int_0^\infty x(t)e^{-st}$dt

= $\int_0^\infty e^{-st}$dt

Let,

e^{-st} = z

=>$\frac{d}{dt}(e^{-st}) = \frac{dz}{dt}$

=>e^{-st}(-s) = $\frac{dz}{dt}$

∴ e^{-st}.dt = - $\frac{1}{s}$ dz .....(I)

= $\int_0^\infty -\frac{1}{s}$ dz

= - $\frac{1}{s}\int_0^\infty dz$ [From (I)]

= - $\frac{1}{s}[z]_2^\infty$

= - $\frac{1}{s}$ $[e^{-st}]_2^\infty$ [∵ e^{-st} = z]

= - $\frac{1}{s}$ $[e^{-\infty} - e^{-2s}]$ [∵ $e^{-\infty} = \frac{1}{e^\infty} = \frac{1}{\infty} = 0$]

= - $\frac{1}{s}$ × - e^{-2s}

= $\frac{e^{-2s}}{s}$

8) The Laplace transform of signal u(t+2) is

(a) $\frac{1}{s}$ (b) -$\frac{1}{s}$ (c) $\frac{e^{-2s}}{s}$ (d) $\frac{-e^{-2s}}{s}$

= Answer (a) $\frac{1}{s}$

9) Find the Laplace transform of x(t) = e^{-at}u(t)

(a) $\frac{1}{s-a}$ (b) $\frac{1}{s+a}$ (c) 0 (d) None

= Answer (b) $\frac{1}{s+a}$

X(s) = $\int_{-\infty}^{\infty} x(t)\, e^{-st}$dt

= $\int_{-\infty}^{\infty} e^{-at}$u(t)$e^{-st}$dt

= $\int_{0}^{\infty} e^{-at}.e^{-st}$dt

= $\int_{0}^{\infty} e^{-t(s+a)}$dt

Let,

$e^{-t(s+a)}$ = z

=> $\frac{d}{dt}\left[e^{-t(s+a)}\right] = \frac{dz}{dt}$

=> - (s+a).$e^{-t(s+a)}$ = $\frac{dz}{dt}$

∴ $e^{-t(s+a)}$dt = $-\frac{1}{(s+a)}$dz

= $\int_{0}^{\infty} -\frac{1}{(s+a)}$dz

= $-\frac{1}{(s+a)}\int_{0}^{\infty} dz$

= - $\frac{1}{(s+a)}[z]_{0}^{\infty}$

= - $\frac{1}{(s+a)}\left[e^{-t(s+a)}\right]_{0}^{\infty}$ [∵ $z = e^{-t(s+a)}$]

= - $\frac{1}{(s+a)}[e^{-\infty} - e^{-0}]$

$= \frac{1}{(s+a)}$

10) The z-transform of δ[n-K],k>0 is

(a) z^k,Z>0 (b) z^{-k},z>0 (c) z^k,z≠0 (d) z^{-k}, z≠0

= Answer (d) z^{-k}, z≠0

11) The z-transform of δ[n+K],k>0 is

(a) z^{-k}, z≠0 (b) z^k,z≠0 (c) z^{-k},all z (d) z^k,all z

= Answer (d) z^k,all z

12) The z-transform of u(n) is

(a) $\frac{1}{1-z^{-1}}$,$|z|$>1 (b) $\frac{1}{1-z^{-1}}$,$|z|$<1 (c) $\frac{z}{1-z^{-1}}$,$|z|$<1 (d) $\frac{z}{1-z^{-1}}$,$|z| > 1$

= Answer (a) $\frac{1}{1-z^{-1}}$,$|z|$>1

13) Which one of the systems described by the following is time invariant ?

(a) y(n) = nx(n) (b) y(n) = x(n) – x(n-1)

(c) y(n) = x(-n) (d) y(n) = x(n)cos2πf_0

= Answer (b) y(n) = x(n) – x(n-1)

14) Which one is casual system

(a) y(n) = 3x(n) – 2x(n-1) (b) y(n) = 3x(n) + 2x(n+1)

(c) y(n) = 3x(n+1) + 2x(n-1) (d) y(n) = 3x(n+1) + 2x(n-1) + x(n)

= Answer (a) y(n) = 3x(n) – 2x(n-1)

15) Which one is most appropriate dynamic system out of the following ?

(a) y(n) = y(n-1) + y(n+1) (b) y(n) = y(n-1)

(c) y(n) = x(n) (d) y(n) + y(n+1) + y(n+3) = 0

= Answer (a) y(n) = y(n-1) + y(n+1)

16) A LTI system is completely characterized by its

(a) unit impulse response (b) time shifted impulses

(c) unit step response (d) response to any signal (bounded)

= Answer (a) unit impulse response

17) From the given conditions,what are the Dirichlet conditions ?

1. x(t) should be absolutely imtegrable.

2. x(t) should have finite discontinuities.

3. x(t) should have finite number of maxima and minima.

(a) 1,2 and 3 (b) 1 and 2 (c) 1 and 3 (d) None of these

= Answer (a) 1,2 and 3

18) A periodic function of half wave symmetry is necessarily

(a) an even function (b) an odd function

(c) both odd and even functions (d) neither odd nor even functions

= Answer (c) both odd and even functions

19) A periodic signal has power P/4 equal to average energy per period then rms value of signal is given by

(a) $\frac{\sqrt{P}}{4}$ (b) P/4 (c) P/2 (d) $\frac{\sqrt{P}}{2}$

= Answer (d) $\frac{\sqrt{P}}{2}$

20) If y(t) = $e^{x(t)}$,then the relation is

(a) dynamic (b) static (c) memory (d) None of these

= Answer (b) static

21) The system y(t) = t^2x(t – 1) is

(a) time invariant (b) linear

(c) linear and time invariant (d) None of the above

= Answer (b) linear

22) Which one of the following is true ?

(a) A finite signal is always bounded

(b) A bounded signal always possesses finite energy

(c) A bounded signal is always zero outside the interval [-$t_{0,}t_0$] for some t_0

(d) A bounded signal is always finite

= Answer (b) A bounded signal always possesses finite energy

23) The impulse response of a casual linear time invariant system is given as h(t).Now,consider the following two statements :

Statement (I) Principle of superposition holds

Statement (II) h(t) = 0 (for t<0)

Which one of the following statements is correct ?

(a) Statement (I) is correct and statement (II) is wrong

(b) Statement (II) is correct and statement (I) is wrong

(c) Both statement (I) and statement (II) are wrong

(d) Both statement (I) and statement (II) are correct

= Answer (d) Both statement (I) and statement (II) are correct

24) As the period of the periodic signal increases,the fundamental frequency

(a) increases (b) decreases (c) remains same (d) depends on T

= Answer (b) decreases

$\because$ f $\propto \frac{1}{T}$

25) Impulse train is a kind of signal which has …….. discontinuity.

(a) infinite (b) zero (c) one (d) finite

= Answer (a) infinite

26) Convolution of step signal 49 times i.e.,49 convolution operation.The Laplace transform will be equal to

(a) $\frac{1}{S^{49}}$ (b) 1 (c) $\frac{1}{S^{50}}$ (d) S^{49}

= Answer (a) $\frac{1}{S^{49}}$

27) The region of convergence of X(s) consists of regions which are

(a) any region in the s-plane not necessarily parallel to the σ or jω-axis

(b) parallel to the jω-axis of the s-plane

(c) parallel to the σ-axis of the s-plane

(d) None of the above

= Answer (b) parallel to the jω-axis of the s-plane

28) The Laplace transform of x(t) can be interpreted as the …….. transform of x(t) after multiplication by real ……. Signal.

(a) Fourier,exponential (b) z-transform,impulse

(c) z-transform,exponential (d) Fouurier,impulse

= Answer (a) Fourier,exponential

29) If a system has all its poles and zeros inside the unit circle,then system is

(a) minimum phase system (b) mixed phase system

(c) maximum phase system (d) None of the above

= Answer (a) minimum phase system

30) A casecade of 3 linear time invariant systems is casual and unstable.From this,we conclude that

(a) each system in the casecade is individually casual and unstable

(b) atleast one system is unstable and atleast one system is casual

(c) atleast one system is casual and all systems are unstable

(d) the majorities are unstable and the minorities are casual

= Answer (b) atleast one system is unstable and atleast one system is casual