

Q1/Choose the correct answer

- 1- A signal can be represented in
  - (a) time domain
  - (b) frequency domain
  - (c) both (a) and (b)
  - (d) none of the above
  
- 2-  $u(t - a) = 0$ , if
  - (a)  $t - a = 0$
  - (b)  $t - a < 0$
  - (c)  $t - a > 0$
  - (d)  $t > a$
  
- 3-  $y(n) = x(2n)$  is for a
  - (a) time-invariant system
  - (b) time varying, dynamic system
  - (c) linear, time varying, dynamic system
  - (d) linear, time-invariant, static system
  
- 4-  $y(n) = x(-n)$  is for a
  - (a) non-causal system
  - (b) linear, causal, time-invariant system
  - (c) linear, non-causal, time-invariant system
  - (d) linear, non-causal, time varying, dynamic system
  
- 5- The most widely used Fourier series is
  - (a) trigonometric series
  - (b) cosine series
  - (c) exponential series
  - (d) none
  
- 6- The exponential Fourier series coefficient  $C_n$  in terms of trigonometric Fourier coefficients is
  - (a)  $C_n = \frac{1}{2}(a_n + jb_n)$
  - (b)  $C_n = \frac{1}{2}(a_n - jb_n)$
  - (c)  $C_n = (a_n - jb_n)$
  - (d)  $C_n = (a_n + jb_n)$

Q2/ Determine whether the signal is energy signal or power signal and calculate their energy or power signal.  $x(t) = \sin^2 \omega_0 t$

Q3/ Determine whether the discrete -time signal is periodic or not?  
If periodic, determine fundamental period

$$\sin(5\pi n)$$

Q4/ Sketch the following signal.

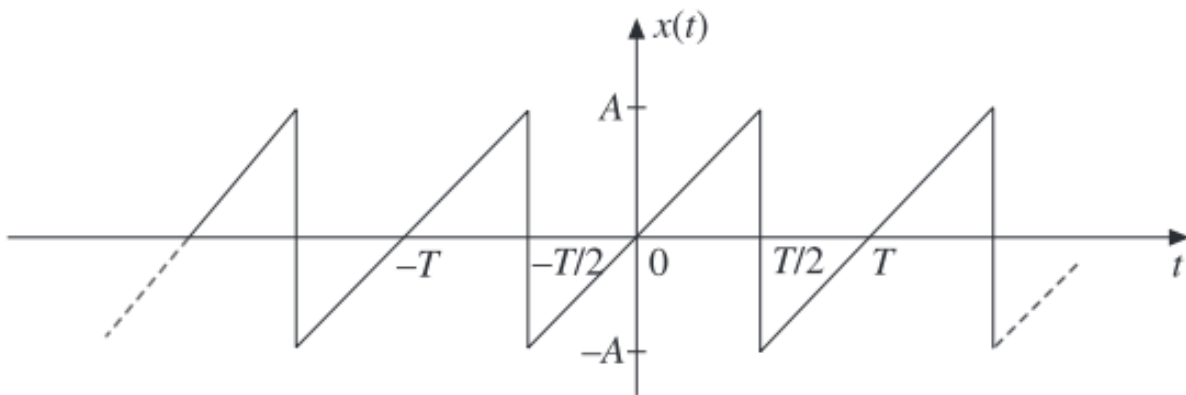
a -  $-2u(t + 2)$

b -  $2r(t - 2)$

Q5/ comment about the linearity, stability, time invariance and causality for the following filter system (6 marks)

$$y(n) = 2x(n + 1) + [x(n - 1)]^2$$

Q6/ Obtain the trigonometric Fourier series for the waveform (5 marks)



The waveform has odd symmetry

$$x(t) = \frac{A}{T/2} t = \frac{2A}{T} t$$

Q7/ Determine whether the following signals are energy signals or power signals, and calculate their energy or power:

- (a)  $t^3 u(t)$                       (b)  $2u(t)$                       (c)  $10e^{-5t} u(t)$                       (d)  $(3 + e^{2t}) u(t)$   
(e)  $(2 + e^{-2t}) u(t)$                       (f)  $r(t - 2) - r(t - 3)$

Q8/ Find which of the following signals are energy signals, power signals, neither energy nor power signals. Calculate the power and energy in each case.

- (a)  $\left(\frac{1}{3}\right)^n u(n)$                       (b)  $e^{j[(\pi/2)n + \pi/2]}$                       (c)  $u(n) - u(n - 4)$

Q9/ Evaluate the following

(a)  $\int_{-\infty}^{\infty} e^{-t^2} \delta(t - 3) dt$                       (b)  $\int_0^{\infty} t^3 \delta(t - 2) dt$

Q10/ Fill in the blanks

1. If a signal depends on only one independent variable, it is called a \_\_\_\_\_ signal.
2. The representation of a signal by mathematical expression is known as \_\_\_\_\_.
3. Continuous-time signals are defined for \_\_\_\_\_.
4. Discrete-time signals are \_\_\_\_\_ in time and \_\_\_\_\_ in amplitude.

Q11/Short question with answers .

1. Define a signal.

*Ans.* A signal is defined as a single-valued function of one or more independent variables which contain some information.

2. What is one dimensional signal?

*Ans.* A signal which depends on only one independent variable is called a one dimensional signal.

Q12/ How are signals classified? Differentiate between them.

Q13/ Derive the relation between complex exponential and sinusoidal signals.

Q14/ Write short notes on the following signals:

- (a) Unit step    (b) Unit impulse  
(c) Unit ramp    (d) Signum

Q15/ Examine whether the following signals are periodic or not. If periodic, determine the fundamental period.

(a)  $\cos 6\pi t$

(b)  $e^{j8\pi t}$

(c)  $2 + \sin 4\pi t$

(d)  $2u(t) + 3 \cos 2\pi t$

(e)  $2 \cos 50\pi t + 3 \sin 25t$

(f)  $3e^{j[4\pi t + (\pi/3)]} + 4e^{-j[2t + (\pi/2)]}$

Q16/ What is homogeneity property?

*Ans.* Homogeneity property means a system which produces an output  $y(t)$  for an input  $x(t)$  must produce an output  $ay(t)$  for an input  $ax(t)$ .

Q17/ What is superposition property?

*Ans.* Superposition property means a system which produces an output  $y_1(t)$  for an input  $x_1(t)$  and an output  $y_2(t)$  for an input  $x_2(t)$  must produce an output  $y_1(t) + y_2(t)$  for an input  $x_1(t) + x_2(t)$ .

Q18/ Define a linear system.

*Ans.* A linear system is a system which obeys the principle of superposition and principle of homogeneity.

Q19/ Define a non-linear system.

*Ans.* A non-linear system is a system which does not obey the principle of superposition and principle of homogeneity.

Q20/

How are systems classified?

*Ans.* The systems are classified as follows:

1. Continuous-time and discrete-time systems
2. Lumped parameter and distributed parameter systems.
3. Static (memoryless) and dynamic (memory) systems
4. Causal and non-causal systems
5. Linear and non-linear systems
6. Time-invariant and time varying systems
7. Stable and unstable systems.
8. Invertible and non-invertible systems