

SIGNALS AND SYSTEMS (ECEN 2103)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group - A (Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
 - (i) What is the area of a unit impulse function?

(a) Zero	(b) Half of unity
(c) Depends on the function	(d) Unity.
 - (ii) What is the other name of a continuous time unit impulse function?

(a) Dirac delta function	(b) Unit function
(c) Area function	(d) Direct delta function.
 - (iii) The type of systems which are characterized by the input and the output quantized at certain levels are called as

(a) analog	(b) discrete
(c) continuous	(d) digital.
 - (iv) Which one of the following systems is causal?

(a) $y(t)=x(t)+x(t-3)+x(t-2)$	(b) $y(n)=x(n+2)$
(c) $y(t)=x(t-1)+x(t-2)$	(d) $y(n)=x(2n-2)$.
 - (v) Which of the following does not vary with time?

(a) Alternating current	(b) Space variable
(c) Independent variables	(d) Dependent variables.
 - (vi) Determine the fundamental period of the following signal: $x(t) = \sin 60t$.

(a) 1/60 sec	(b) 1/30 sec
(c) 1/20 sec	(d) 1/10 sec.
 - (vii) Determine the time period of: $x(t)=3 \cos(20t+5) + \sin(8t-3)$.

(a) 1/10 sec	(b) 1/20 sec
(c) 2/5 sec	(d) 2/4 sec.
 - (viii) Determine the odd component of the signal: $x(t)=\cos t+\sin t$.

(a) $\sin t$	(b) $2\sin t$
(c) $\cos t$	(d) $2\cos t$.

- (ix) If $x(-t) = -x(t)$ then the signal is said to be

(a) Even signal	(b) Odd signal
(c) Periodic signal	(d) Non periodic signal.
- (x) Noise generated by an amplifier of radio is an example for

(a) Discrete signal	(b) Deterministic signal
(c) Random signal	(d) Periodic signal.

Group - B

2. (a) What is unit step function and unit impulse function? Define its expression and sketch its respective graph.
- (b) Sketch the following signal:
 - (i) $u(-t+2)$
 - (ii) $-2u(t+2)$.

6 + (3 + 3) = 12

3. (a) Define causal and non-causal signals?
The signal is given as $x(t) = e^{2t}u(t-1)$. Determine whether the signal is causal or not?
- (b) Find the even and odd components of the signal stated below:
The signal is $x(t) = e^{j2t}$
Distinguish between periodic and aperiodic signals.

(4 + 2) + (2 + 4) = 12

Group - C

4. (a) Differentiate between time-invariant and time varying systems. Distinguish between static and dynamic systems.
- (b) What are Dirichlet's conditions?
Prove the linearity property of continuous time Fourier series.

(3 + 3) + (4 + 2) = 12

5. (a) Find the Fourier transform of an impulse signal given as $\delta(t)$.
- (b) State and prove any two properties of Fourier transform.

6 + 6 = 12

Group - D

6. (a) Find the Fourier transform of the following signals:
 - (i) $e^{-3t}u(t)$
 - (ii) $\cos \omega_0 t u(t)$.

- (b) Find the convolution of the following signal using graphical method;

$$x_1(t) = e^{-2t} u(t); \text{ and } x_2(t) = e^{-4t} u(t).$$

$$(3 + 3) + 6 = 12$$

7. (a) Define sampling theorem. What do you mean by Nyquist rate of sampling?

- (b) When does aliasing occur? How can it be avoided?

$$(3 + 3) + (3 + 3) = 12$$

Group – E

8. (a) Write the properties of probability density function.

- (b) What is white noise? Draw the probability density function of white noise.

$$6 + (3 + 3) = 12$$

9. Write short notes on any three (3) topics:

(i) Probability density function.

(ii) Correlation function.

(iii) Properties of autocorrelation functions.

(iv) Power spectral density.

(v) Time-invariant and time-variant systems.

(vi) Convolution.

$$(4 + 4 + 4) = 12$$