ROLL NO. ________________

Code: AE57/AC57/AT57/AE112 Subject: SIGNALS AND SYSTEMS

AMIETE – ET/CS/IT (Current & New Scheme)

Time: 3 Hours **DECEMBER 2018** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. Let $\boldsymbol{\delta}$ (t) denotes the delta function. The value of the integral $\int_{-\infty}^{\infty} \delta(t)\cos(\frac{3t}{2})dt$ is

(A) 1 **(B)** -1
(C) 0 **(D)** π/2

b. Unit step function can be defined as

(A) u(t) = $\begin{cases} 1, & t = 0 \\ 0, & t \neq 0 \end{cases}$ **(B)** u(t) = $\begin{cases} 0, & t < 0 \\ 1, & t \geq 0 \end{cases}$

(C) u(t)=1, t=1 **(D)** u(t) = $\begin{cases} 1, & t < 0 \\ 0, & t \geq 0 \end{cases}$

c. A system with an input $x(t)$ and output $y(t)$ is described by the relation , $y(t) = t\,x(t)$. This system is

(A) Linear and time invariant system
(B) Non –linear and time invariant
(C) Linear and time variant
(D) Non – linear and time variant

d. The causal DT-LTI system is stable if,

(A) $\sum_{n=0}^{\infty} |h(n)| < \infty$ **(B)** $\sum_{n=0}^{\infty} |h(n)|^2 < \infty$
(C) $\sum_{n=0}^{\infty} |h(n)| = 0$ **(D)** $\sum_{n=0}^{\infty} |h(n)|^2 = 0$

e. The Fourier series for the function f (x) = $\sin^2 x$

(A) sin$x$ + sin2x **(B)** 1- cos2x
(C) sin2x + cos2x **(D)** 0.5 - 0.5 cos2x

f. The Fourier transform of a function x(t) is x(f) . The Fourier transform of $\frac{d(t)}{dt}$ will be

(A) $\frac{d(f)}{dt}$ **(B)** j2πf x(f)

(C) jf(f) **(D)** $\frac{x(f)}{jf}$

g. The property of Fourier transform which states that the compression in time domain is equivalent to expansion in the frequency domain is

(A) Duality **(B)** Scaling
(C) Time Scaling **(D)** Frequency shifting

h. The inverse Laplace transform of the function $\frac{s+5}{(s+1)(s+3)}$ is

(A) $2e^{-t} - e^{-3t}$ **(B)** $2e^{-t} + e^{-3t}$
(C) $e^{-t} - 2e^{-3t}$ **(D)** $e^{-t} + e^{-3t}$

i. If the impulse response of a discrete time system is $h(n) = -5^n u(-n-1)$. Then the system function H(*z*) is equal to

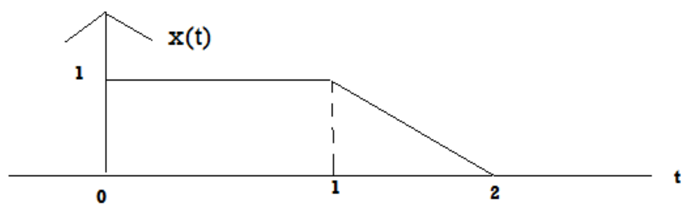
(A) $\frac{-z}{z-5}$ & system is stable **(B)** $\frac{-z}{z-5}$ & system is unstable
(C) $\frac{z}{z-5}$ & system is stable **(D)** $\frac{z}{z-5}$ & system is unstable

j. The auto correlation function Rx (τ) has its maximum magnitude at

(A) $|R_x(\tau)| \le R_x(0)$ **(B)** $|R_x(\tau)| \ge R_x(0)$
(C) $|R_x(\tau)| = R_x(1)$ **(D)** $|R_x(\tau)| \le R_x(1)$

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. A continuous time signal show in figure below: **(8)**



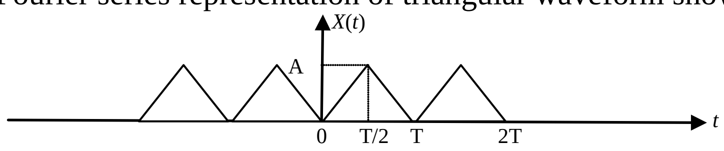
Sketch the following signals.

(i) $x(t + 1)$ (ii) $x(\frac{3}{2}t - 1)$
(iii) $4x(-t + 5)$ (iv) $-5x(-2t + 3)$

b. Check whether the systems **(8)**
(a) $y(t) = x(t)\cos\omega t$ (b) $y(n) = x(n)x(n-1)$ are
(i) linear or non linear
(ii) Causal or non –causal
(iii) Time invariant or time variant

Q.3 a. State and prove Parseval's theorem of Fourier series. **(4)**

b. Find the Fourier series representation of triangular waveform shown below: **(12)**



Q.4. a. Find the continuous time Fourier transform of the signal,
$x(t) = e^{-a(t)}$, a > 0 also sketch $x(t)$ and $x(j\omega)$. **(8)**

b. Find the linear convolution of $x(n) = \{1, 2, \underset{\uparrow}{3}, 4\}$ & $h(n) = \{2,-4, 6, \underset{\uparrow}{8}\}$ using graphical method. **(8)**

Q.5 a. Explain following properties of discrete time Fourier transform **(3x4)**
(i) Time shifting and frequency shifting
(ii) Time Reversal
(iii) Convolution property
(iv) Differentiation in frequency

b. If $x(n) = a^n u(n)$ and $h(n) = b^n u(n)$, find $y(n) = x(n) * h(n)$. **(4)**

Q.6 a. State sampling theorem. With necessary diagram explain the representation of a continuous time signal by its samples. **(8)**

b. Explain the reconstruction of a signal from its samples using interpolation. **(8)**

Q.7 a. Using Laplace transform find the impulse response of H(s) = $\frac{10}{S^2+6s+10}$. **(4)**

b. Using Laplace transform , solve the differential equation

$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = \frac{dx(t)}{dt}$ if $y(\bar{0}) = 2$, $\frac{dy(\bar{0})}{dt}$ and $x(t) = e^{-t}u(t)$ **(12)**

Q.8 a**.** Find inverse z-transform using partial fraction expansion method

$x(z) = \frac{z-4}{(z-1)(z-2)^2}$ **(12)**

b. Define z- transform. Explain the relationship between z- transform and discrete time Fourier transform. **(4)**

Q.9 a. Derive the power spectral density of Gaussian noise. **(6)**

b. Define Mean Correlation and Covariance function . **(6)**

c. Explain narrow band noise. **(4)**