

AMIETE – ET/CS/IT (OLD SCHEME)

Time: 3 Hours

OCTOBER 2012

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)

- Signal $x(t) = 2\cos(0.5t)$ represents a

(A) Full wave rectified signal	(B) Half wave rectified signal
(C) Sinusoidal signal	(D) Cosine signal.
- If $f_{xy}(x, y) = f_x(x) \cdot f_y(y)$ then x and y variables are

(A) correlated	(B) independent
(C) dependent	(D) cross-correlated.
- LTI system represented by $y(n) = x(n) + x(n-1)$ is

(A) always linear	(B) linear if $n=1$
(C) non-linear	(D) linear if $n = -1$
- To find harmonics of a signal _____ is used.

(A) Fourier transforms	(B) Fourier series
(C) Z-transform	(D) Laplace transform
- Real part of Fourier transform is _____ function of frequency.

(A) positive	(B) odd
(C) even	(D) impulse
- If $y(t) = dx(t)/dt$ then $H(j\omega)$ will be

(A) $j\omega$	(B) $-j\omega$
(C) ω	(D) $j\omega x(t)$.
- The signal $x(n) = \delta(n)$, then $X(e^{j\omega})$ results as

(A) 1	(B) 0
(C) -1	(D) $-j\omega$

Code: AE06/AC04/AT04

Subject: SIGNALS & SYSTEMS

- h. $\delta(n-1) * \delta(n+1)$ will result in
- (A) Zero (B) Always 1
(C) n (D) can't decide from given data.
- i. If $\frac{dy(t)}{dt} + 3y(t) = x(t)$, the system function will be
- (A) $1/(S+3)$ (B) $1/(S-3)$
(C) $S+3$ (D) $S-3$
- j. The ROC does not contain any
- (A) other ROC (B) unit circle
(C) zeros (D) poles

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

- Q.2** a. If $x(n) = \{1, 1, 1, 1, 1/4, 1/4\}$
- ↑
- (i) Sketch $x(n)$.
(ii) Sketch $x(n) \cdot u(2-n)$
(iii) Sketch $x(n-1) \cdot \delta(n-3)$. (6)
- b. Prove that
- (i) $\delta(n) = u(n) - u(n-1)$.
(ii) $y(t) = x(2t)$ is causal system.
(iii) $x(t) = A e^{-at} u(t)$ is an energy signal. (6)
- c. Differentiate continuous-time and discrete-time systems. (4)
- Q.3** a. For the signal
 $x(n) = 1 + \sin(2\pi/N)n + 3\cos(2\pi/N)n + \cos(2\pi n/N + 90^\circ)$.
 (i) Determine the Fourier series co-efficients for $N = 5$ for the above signal.
 (ii) Plot real and imaginary parts of the Fourier series co-efficients.
 (iv) Plot magnitude and phase of the same Fourier series co-efficients. (9)
- b. Plot impulse train $\delta(t)$ with period T . Determine its Fourier series representation. State its area of application(s). (7)
- Q.4** a. If $G(j\omega)$ is the Fourier transform of the signal $g(t) = 2/(1+t^2)$. Determine $G(j\omega)$. Comments on the result obtained. (8)
- b. For the signal $x(n) = \cos(\omega_0 n)$, determine and sketch its discrete time Fourier transforms. Assume $\omega_0 = (2\pi/5)$. (8)
- Q.5** a. First-order system's differential equation is described by $\tau \frac{dy(t)}{dt} + y(t) = x(t)$; where τ = time-constant of the system,

Code: AE06/AC04/AT04

Subject: SIGNALS & SYSTEMS

- (i) Obtain frequency response
 (ii) Obtain impulse response
 (iii) Obtain step response of the system
 (iv) If τ is made smaller, what will be its effect on time response of the system? (8)
- b. Define and explain interpolation. Enlist its various types. Discuss any one interpolation method in detail. (8)
- Q.6** a. State and prove initial value theorem and final value theorem for Z-transform. Obtain the initial and final value of $x(z) = 2 + 3z^{-1} + 4z^{-2}$. (8)
- b. Explain the following properties for Z- transform.
 (i) time shifting (ii) time reversal
 (iii) time expansion (iv) scaling (8)
- Q.7** a. For an LTI system , the following data is given
 (i) The system is causal
 (ii) The system function is rational and has only two poles at $s = -2$ and $s = +4$.
 (iii) If $x(t) = 1$, then $y(t) = 0$.
 (iv) The value of the impulse response at $t = 0^+$ is 4.
 Determine system function from the above data using Laplace transformation only. (8)
- b. Obtain the Laplace transform of
 (i) $x(t) = t e^{-at} u(t)$
 (ii) $x(t) = [2 t e^{-t} - t e^{-t} + 3 e^{-2t}] u(t)$ (8)
- Q.8** a. If $X(S) = 1 / \{(s +1) (s +2)\}$ with $\text{Re}\{s\} > -1$; obtain inverse Laplace Transform. Also, sketch pole-zero plot clearly indicating ROC. (8)
- b. A causal LTI system described by the difference equation $y(n) + 3y(n-1) = x(n)$ with system initially relaxed. Obtain $y(n)$ if $x(n) = \alpha u(n)$, where α is a given constant using unilateral Z-transformation. (8)
- Q.9** a. Write short note on:-
 (i) Cross-spectral density between input and output.
 (ii) Cross-correlation between input and output. (8)
- b. If an amplitude X of a Gaussian signal $x(t)$ has a mean value of 2 and mean square value of 3. Determine and state its PDF. (8)