ROLL NO. _____

Code: AE06/AC04/AT04 **Subject: SIGNALS & SYSTEM**

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)**

a. 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.

b. 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.

c. 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

d. To find harmonics of a signal _____ is used.

(A) Fourier transforms **(B)** Fourier series
(C) Z-transform **(D)** Laplace transform

e. Real part of Fourier transform is _____function of frequency.

(A) positive **(B)** odd
(C) even **(D)** impulse

f. If $y(t) = dx(t)/dt$ then H(jw) will be

(A) jw **(B)** –jw
(C) w **(D)** jw x(t).

g. The signal $x(n) = \delta(n)$, then $X(e^{jw})$ results as

(A) 1 **(B)** 0

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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 $d\,y(t)/dt + 3y(t) = x(t)$, 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).u(2-n)
(iii) Sketch x(n-1).δ(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
$x(n) = 1 + \sin(2\pi / N) n + 3 \cos(2\pi / N) n + \cos(2\pi n / N + 90^o)$.
(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 δ(t) with period T. Determine its Fourier series representation. State its area of application(s). **(7)**

Q.4 a. If G(jw) is the Fourier transform of the signal $g(t) = 2/(1+t^2)$. Determine G(jw). Comments on the result obtained. **(8)**

b. For the signal $x(n) = \cos(w_o n)$, determine and sketch its discrete time Fourier transforms. Assume $w_o = (2\pi / 5)$. **(8)**

Q.5 a. First-order system's differential equation is described by $\tau\, dy(t)/dt + y(t) =$

(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 $x(z) = 2 + 3z^{-1} + 4 z^{-2}$. **(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) $x(t) = [2 t e^{-t} - te^{-t} + 3 e^{-2t}]u(t)$ **(8)**

Q.8 a. If $X(S) = 1/ \{(s +1) (s +2)\}$ with $Re\{s\} > -1$; 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)**