
AMIETE – ET/CS/IT (NEW SCHEME)

Time: 3 Hours

DECEMBER 2011

Max. Marks: 100

NOTE: There are 9 Questions in all.

- Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.
- 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. Fourier coefficient of repetitive impulse $\delta_T(t)$ with time period T is given by

- | | |
|-----------|------------|
| (A) $1/T$ | (B) T |
| (C) $2T$ | (D) 2π |

b. System defined by $y(n) = x(n) \cdot x(n-2)$ is memory less

- | | |
|------------------------------|--------------------|
| (A) yes | (B) no |
| (C) requires additional data | (D) can't defined. |

c. Analog signal of bandwidth B is sampled at the minimum Nyquist rate. The folding frequency will be

- | | |
|-----------|-------------|
| (A) $2B$ | (B) $B*B$ |
| (C) $B/2$ | (D) B only. |

d. A discrete-time LTI system is BIBO stable if its impulse response is

- | | |
|--------------------------|-------------------------------|
| (A) absolutely summable, | (B) integrable |
| (C) divisible | (D) requires additional data. |

e. Fig .1 shows _____ signal.
(Fill the blank.)

- | |
|----------------|
| (A) Odd |
| (B) Even |
| (C) Continuous |
| (D) Real part |

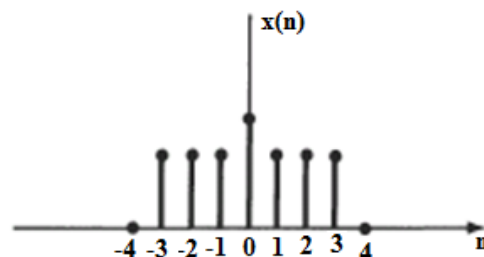


Fig.1

f. Laplace transform of unit step function is

- (A) s (B) 1/2s
(C) 1/s (D) 2/s.

g. $X(t) \leftrightarrow 2\pi x(-w)$ indicates _____ property of Fourier transform,

- (A) Duality (B) symmetry
(C) both (A) and (B) (D) time reversal.

h. $x(-n) \leftrightarrow X(1/z)$ defines the following property of Z-transform

- (A) time-scaling (B) time-expansion
(C) time-reversal (D) time-domain.

i. Ideal low-pass filter or continuous –time and discrete –time introduce _____ phase distortion. (fill blank)

- (A) all (B) dispersion
(C) constant (D) zero

j. Parseval's relation for a periodic signal $\int_{-\infty}^{\infty} |x(t)|^2 dt$ equal to

- (A) $\frac{1}{2\pi} \int_{-\infty}^{\infty} |X(j\omega)|^2 d\omega$ (B) $\int_{-\infty}^{\infty} |X(j\omega)|^2 d\omega$
(C) $\frac{1}{\pi} \int_{-\infty}^{\infty} |X(j\omega)|^2 d\omega$ (D) None of the above

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

Q.2 a. Prove that

- (i) $\delta(n) = u(n) - u(n-1)$
(ii) $r(n) = n u(n)$
(iii) Discrete - time unit step is running sum of the unit impulse.
(iv) Power of the signal $x(t) = \cos(t)$ is 0.5. (8)

b. Draw block diagram representation of causal LTI systems described by the following difference equations:

- (i) $y(n) = 0.5 y(n-1) + 0.25 x(n)$ and (ii) $d y(t)/dt + 3y(t) = x(t)$. (8)

Q.3 a. Find the Exponential Fourier series for the signal shown in Fig. 2 (8)

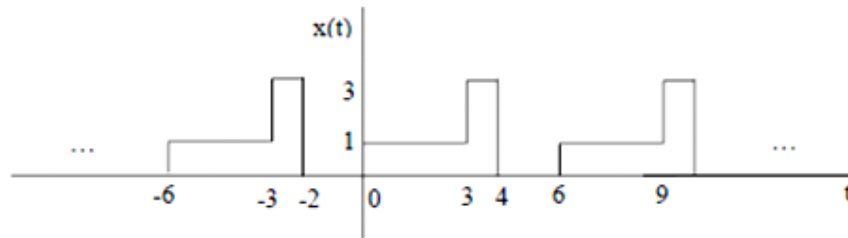


Fig.2

- b. State and explain the properties of discrete time Fourier series. (8)
- Q.4** a. The response of an LTI system with impulse response $h(t) = e^{-at} u(t)$, $a > 0$, to the input signal $x(t) = e^{-bt} u(t)$, $b > 0$; find the output signal $y(t)$. (8)
- b. An LTI system whose response to the input $x(t) = [e^{-t} + e^{-3t}] u(t)$ is $y(t) = [2e^{-t} - e^{-4t}] u(t)$. Find
 (i) The frequency response of the system.
 (ii) The differential equation relating the input and output of this system. (8)
- Q.5** a. Consider a causal LTI system characterized by the difference equation $y(n) - (3/4)y(n-1) + (1/8)y(n-2) = 2x(n)$; Obtain impulse response of the system using discrete - time Fourier transform. (8)
- b. State and prove the convolution and multiplication properties of discrete Fourier Transform. (8)
- Q.6** a. Define Group delay. Consider the following frequency response for a causal and stable LTI system: $H(j\omega) = (1-j\omega) / (1+j\omega)$.
 (i) If $|H(j\omega)| = A$, and determine the value of A.
 (ii) Show that $\tau(\omega) > 0$ for $\omega > 0$; where $\tau(\omega)$ is group delay of the system (8)
- b. State and prove the sampling theorem for low pass signal and band pass signal and also explain the reconstruction of signal from its sample value. (8)
- Q.7** a. For an LTI system the input is given by $x(t) = e^{-3t} u(t)$ and the output is given by $y(t) = [e^{-t} - e^{-2t}] u(t)$. Determine the system function, ROC and characteristic equation of the system using Laplace Transform. (8)
- b. For the circuit shown in Fig. 3,
 (i) Determine the system function $H(s)$ and
 (ii) Impulse response $h(t)$ using Laplace transformation only (8)

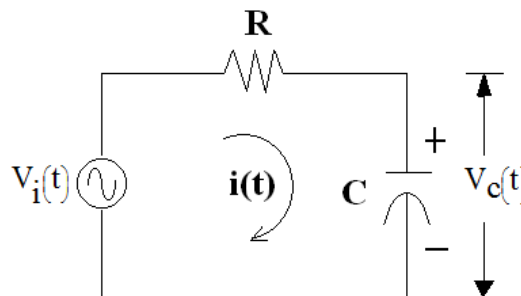


Fig. 3

- Q.8** a. Consider the signal $x(n) = a^n$, $0 \leq n \leq N-1$, $a > 0$ and 0 otherwise. Find $X(Z)$, state ROC and plot the pole-zero pattern for $N=8$. (8)
- b. Find Inverse Z-transform of (8)
- (i) $X(z) = (1/1024) [(1024 - z^{-10}) / (1 - 0.5z^{-1})]$, $|z| > 0$.
- (ii) $X(z) = \log(1 + az^{-1})$, $|z| > |a|$.
- Q.9** a. A Continuous random variable X is uniformly distributed between 0 and π . Determine the CDF and PDF for the random variable X . (8)
- b. Define and explain the following terms as applied to random variables: (8)
- (i) Mean,
 - (ii) Variance
 - (iii) Co-variance
 - (iv) Autocorrelation.