

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

Time: 3 Hours

June 2017

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. Consider the voltage waveform (fig. 1):

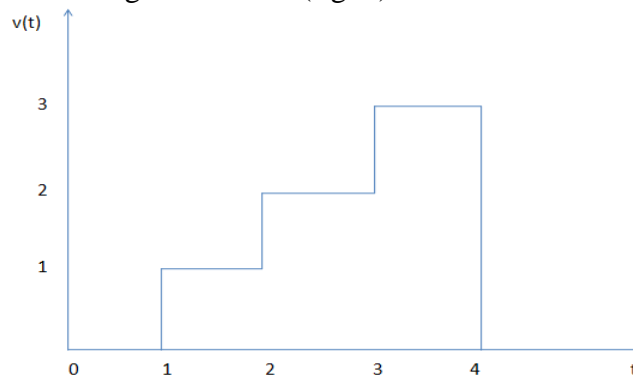


Fig. 1

The equation for $v(t)$ is:

- (A) $u(t-1) + u(t-2) + u(t-3)$ (B) $u(t-1) + 2u(t-2) + 3u(t-3)$
 (C) $u(t-1) + u(t-2) + u(t-4)$ (D) $u(t-1) + u(t-2) + u(t-3) - 3u(t-4)$
- b. A discrete time signal is given as: $x(n) = \cos(n/8) \cos(\pi n/8)$. It is
 (A) periodic with period of 16π (B) periodic with period of $16(\pi + 1)$
 (C) periodic with period of 8 (D) Non periodic
- c. Let $x[n]$, $-5 \leq n \leq 3$ and $h[n]$, $2 \leq n \leq 6$ be two finite duration signals.
 The range of their convolution is
 (A) $-7 \leq n \leq 9$ (B) $-3 \leq n \leq 9$
 (C) $2 \leq n \leq 3$ (D) $-5 \leq n \leq 6$

d. Consider two signals given below:

$$x[n] = \{1, -2, 3\}; h[n] = \{0, 0, 1, 1, 1, 1\}$$

\uparrow \uparrow
 (under the 1st element of x[n] and the 3rd element of h[n])

The convolution of $x[n]$ and $h[n]$ is

- (A) $\{1, -2, 4, 1, 1, 1\}$ (B) $\{0, 0, 3\}$
 \uparrow \uparrow
 (C) $\{0, 0, 3, 1, 1, 1, 1\}$ (D) $\{0, 0, 1, -1, 2, 2, 1, 3\}$
 \uparrow \uparrow
 (under the 1st element of (C) and the 1st element of (D))

- e. The impulse response of a continuous-time LTI system is $h(t) = e^{-t} u(t-2)$. The system is
 (A) causal and stable (B) causal but not stable
 (C) stable but not causal (D) neither causal nor stable
- f. The Laplace Transform of the signal $e^{2t} u(-t+2)$ is
 (A) $(e^{2(s-2)} - 1) / (s-2)$ (B) $e^{-2s} / (s+2)$
 (C) $(1 - e^{-2(s-2)}) / (s-2)$ (D) $e^{-2s} / (s-2)$
- g. The Z-transform of $x[n] = [2, 4, 5, 7, 0, 1]$ is
 (A) $2z^2 + 4z + 5 + 7z + z^3 ; z \neq \infty$
 (B) $2z^{-2} + 4z^{-1} + 5 + 7z + z^3 ; z \neq \infty$
 (C) $2z^{-2} + 4z^{-1} + 5 + 7z + z^3 ; 0 < |z| \leq \infty$
 (D) $2z^2 + 4z + 5 + 7z^{-1} + z^{-3} ; 0 < |z| < \infty$
- h. Comment on the time invariance behaviour of the following systems.
 (A) $y(n) = n x(n)$ (B) $y(n) = x(n) - x(n-1)$
 (C) $y(n) = x(-n)$ (D) $y(n) = x(n) \cos 2\pi n f_0$
- i. Test for a causal system among the following:
 (A) $y(n) = 3x(n) - 2x(n-1)$ (B) $y(n) = 3x(n) + 2x(n+1)$
 (C) $y(n) = 3x(n+1) + 2x(n-1)$ (D) $y(n) = 3x(n+1) + 2x(n-1) + x(n)$
- j. Determine a dynamic system among the following.
 (A) $y(n) = y(n-1) + y(n+1)$ (B) $y(n) = y(n-1)$
 (C) $y(n) = x(n)$ (D) $y(n) + y(n+1) + y(n+3) = 0$

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

- Q.2** a. Explain the importance of
 (i) Impulse function (ii) Step function (6)

- b. Decompose the signal $x(t)$ shown in fig. 2 in terms of basic signals such as delta, step and ramp. Also determine Laplace transform of $x(t)$. (6 + 4)

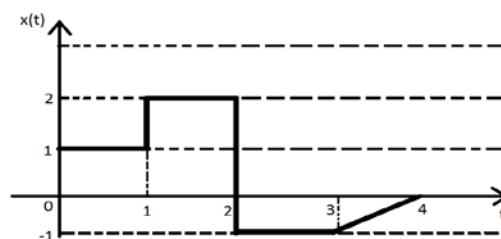


Fig. 2

- Q.3** a. Define the exponential form of Fourier series for a periodic signal $x(t)$ with period T . Derive an expression for Fourier coefficients c_n of exponential form of Fourier series. (8)
- b. Establish the relation between Fourier coefficients of trigonometric and exponential form. (8)

- Q.4** a. Mention four properties of Fourier Transform. Also derive the following properties: (8)
 (i) Time shifting (ii) Frequency shifting

- b. Determine Fourier Transform of the periodic impulse function shown in fig 3. (8)

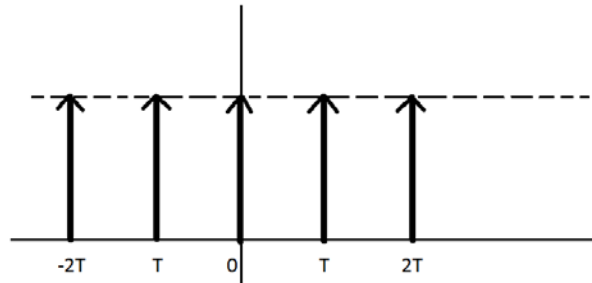


Fig. 3

- Q.5** a. Find the DTFT of $x(n) = [u(n) - u(n - N)]$. (8)

- b. Determine the response of the LTI system whose input $x(n)$ and impulse response $h(n)$ are given by: (8)

$$x(n) = \{1, 2, 3, 1\}; \quad h(n) = \{1, 2, 1, -1\}$$

\uparrow
 $n=0$

\uparrow
 $n=0$

- Q.6** a. Explain sampling of discrete time signal. (6)

- b. Find discrete-time Fourier Transform and plot the spectrum for $x(n) = (1/2)^n u(n)$. (6+4)

- Q.7** a. Explain the term ROC.
 Mention four properties of ROC for Laplace Transform. (2+4)

- b. Consider a signal $x(t) = e^{-2t}u(-t) + e^{-3t}u(t)$. Determine its Laplace Transform and locate the poles, zeros and the ROC in the $s -$ plane. (4 + 6)

- Q.8** a. Explain in detail, causality and stability of a discrete-time system. (8)

- b. A causal LTI system is described by the difference equation $y(n] = y(n-1) + y(n-2) + x(n-1)$.
 Find: (i) Transfer function for the system
 (ii) Unit impulse response of the system (4+4)

- Q.9** Answer the following: (4×4)

- a. Ergodic Process
- b. Stationary Process
- c. Power Spectrum Density
- d. Narrowband noise