

AMIETE – ET (Current & New Scheme)

Time: 3 Hours

JUNE 2016

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. $y[n] = x[-n]$ is for a
- Non causal system
 - Linear, causal, time invariant system
 - Liner, non-causal, time invariant system
 - Linear, non-causal, time varying, dynamic system
- b. The Fourier series of the signal $x(t) = \sin\left(\frac{2\pi}{t}\right)$, $0 < t \leq 1$ cannot be determined because
- $x(t)$ is not absolutely integrable
 - It has more than finite number of maxima and minima in any single period
 - In any finite interval the signal does not have finite number of discontinuities
 - None of these
- c. Let ' $x(t)$ ' the continuous time signal has a Fourier transform $X(j\omega)$. What will be the Fourier transform of the signal if ' $x(t)$ ' is differentiated twice?
- $j\omega X(j\omega)$
 - $-\omega^2 X(j\omega)$
 - $-j\omega^2 X(j\omega)$
 - $-j\omega X(j\omega)$
- d. If a discrete time signal $x[n]$ has discrete time Fourier transform of $X(e^{j\omega})$. What is the Fourier transform of the signal $nx(n)$
- $j \frac{dX(e^{j\omega})}{d\omega}$
 - $-j \frac{dX(e^{j\omega})}{d\omega}$
 - $\frac{dX(e^{j\omega})}{d\omega}$
 - $-\frac{dX(e^{j\omega})}{d\omega}$
- e. Linear phase characteristics correspond to _____ at all frequencies.
- Variable Delay
 - No Delay
 - Constant Delay
 - None of these

- f. In Fourier transform _____ captures the information about the edges.
 (A) Phase (B) Magnitude
 (C) Both Phase and Magnitude (D) None of these
- g. If $x(t)$ has Laplace transform $X(s)$ then what will be the Laplace transform of the signal $tx(t)$?
 (A) $\frac{dX(s)}{ds}$ (B) $-s \frac{dX(s)}{ds}$
 (C) $s \frac{dX(s)}{ds}$ (D) $-\frac{dX(s)}{ds}$
- h. The Laplace transform of the signal $x(t)$ is given by $X(s) = \frac{s+1}{(s+2)s}$. What is the final value of the signal?
 (A) 1 (B) 0
 (C) $\frac{1}{2}$ (D) Infinity
- i. What is the ROC of the Z-transform of $\delta[n]$?
 (A) Entire z-plane including $z = 0$ and $z = \infty$
 (B) Entire z-plane excluding $z = \infty$
 (C) Entire z-plane excluding $z = 0$
 (D) None of these
- j. What is the Z-transform of unit step signal?
 (A) $\frac{z}{z-1}$ (B) $-\frac{z}{z-1}$
 (C) $\frac{1}{z-1}$ (D) z

Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

- Q.2** a. (i) Explain Causal and non-causal systems
 (ii) Determine whether the system $y[n] = nx[n]$ is time variant or not.
 (iii) Determine whether the system $y(t) = x^2(t)$ is invertible or not. (9)
 b. Determine the convolution of (7)

$$x[n] = \left(\frac{1}{2}\right)^n u[n] \quad \text{and} \quad h[n] = u[n] - u[n-10]$$

- Q.3** a. Explain the definition of Mean, Correlation and Covariance function. (8)
 b. Discuss in detail about thermal noise & white noise. (8)

- Q.4** a. Let us consider the signal

$$x[n] = 1 + \sin\left(\frac{2\pi}{N}n\right) + 3\cos\left(\frac{2\pi}{N}n\right) + \cos\left(\frac{4\pi}{N}n + \frac{\pi}{2}\right)$$

The signal is periodic with period N. Find the Fourier series coefficient for the signal. (8)

- b. Explain about the following properties of Discrete Time Fourier Series. (8)
 (i) Time shifting
 (ii) First Difference

- Q.5** a. Consider a rectangular pulse signal (6)

$$x(t) = \begin{cases} 1 & |t| < T_1 \\ 0 & |t| > T_1 \end{cases}$$

Find its Fourier transform.

- b. By using *duality* property find the Fourier transform $G(j\omega)$ of the signal

$$g(t) = \frac{2}{1+t^2} \cdot \quad (10)$$

- Q.6.** a. Determine the DTFT of the following signals (8)

(i) $x[n] = a^n u[n]$

(ii) $x[n] = -a^n u[-n-1]$

- b. Explain the following properties of DTFT (8)
 (i) Parseval's relation.
 (ii) Differentiation in time domain

- Q.7** a. What is limitation of impulse train sampling? Discuss the method of sampling with a Zero-Order Hold. (8)

- b. Explain the process of sampling of discrete time signals. (8)

- Q.8** a. Consider the Laplace transform $X(s) = \frac{2s^2 + 5s + 5}{(s+1)^2(s+2)}$ (10)

Apply inverse Laplace transform to determine $x(t)$.

- b. Explain initial and final value theorem in Laplace Transform. (6)

- Q.9** a. Determine the inverse Z-Transform of the following (8)

$$X(z) = \log(1 + az^{-1}), \quad |z| > |a|$$

- b. Consider an LTI system for which the input $x[n]$ and output $y[n]$ satisfy the linear constant-coefficient difference equation (8)

$$y[n] - \frac{1}{2}y[n-1] = x[n] + \frac{1}{2}x[n-1]$$

Determine its impulse response.