## AMIETE - ET/CS/IT (Current \& New Scheme)

Time: 3 Hours
JUNE 2015
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 $\mathbf{Q} .1$ 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:
a. In memoryless system
(A) zero state response is zero
(B) zero input reponse is zero
(C) both response are zero
(D) both response are finite
b. Which system is non-causal system
(A) $\mathrm{y}(\mathrm{n})=\mathrm{x}(\mathrm{n}-1)$
(B) $y(n)=2 x(n)$
(C) $y(n)=x(n)+A$
(D) $y(n)=x(2 n)$
c. The energy of the signal $\mathrm{x}[\mathrm{n}]=2 \delta(\mathrm{n})+2 \delta(\mathrm{n}-1)+3 \delta(\mathrm{n}-2)-2 \delta(\mathrm{n}-3)$ is
(A) 22 J
(B) 21 J
(C) 50 J
(D) 0 J
d. The discrete LTI system is represented by impulse response $h[n]=(2)^{n} u[-n]$. then, the system is
(A) noncausal and stable
(B) noncausal and unstable
(C) causal and unstable
(D) causal and stable
e. Laplace transform of $\frac{d x(t)}{d t}$ is
(A) $\frac{1}{\mathrm{~s}} \mathrm{x}(\mathrm{s})$
(B) $s^{2} x(s)$
(C) $s x(s)$
(D) $x(s) / s^{2}$
f. Z-transform of $\mathrm{x}\left[\mathrm{n}-\mathrm{n}_{0}\right.$ ]
(A) $\mathrm{X}\left[\mathrm{Z}_{0}\right]$
(B) $\mathrm{Z}^{\mathrm{n}_{0}} \mathrm{X}[\mathrm{Z}]$
(C) $\mathrm{X}\left[\mathrm{Z}+\mathrm{Z}_{0}\right]$
(D) $\mathrm{Z}^{-\mathrm{n}_{0}} \mathrm{X}[\mathrm{Z}]$
g. Fourier transform of $x(t)=\delta(t)$ is
(A) zero
(B) $\delta(\omega)$
(C) $2 \pi \delta(\omega)$
(D) 1
h. To reconstruct message signal from the sampled values, at the receiver we use
(A) High pass filter
(B) Low pass filter
(C) Band pass filter
(D) All pass filter
i. Discrete time fourier transform is always periodic in $\omega$ with period
(A) $\pi$
(B) $2 \pi$
(C) $3 \pi$
(D) None of these
j. Autocorrelation function of white noise signal is
(A) Rayleigh function
(B) Gaussian function
(C) a Delta function
(D) Binomial function

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.
Q. 2 a. Determine power and energy of the following signals
(i) $\mathrm{x}(\mathrm{t})=\mathrm{Ae}^{\mathrm{j} \omega_{0} \mathrm{t}}-\infty<\mathrm{t}<\infty$
(ii) $x(t)=\sin (\omega t)$
b. Find the convolution of $\mathrm{X}_{1}(\mathrm{t})=\mathrm{A} ; 0 \leq \mathrm{t} \leq \mathrm{T}$ and $\mathrm{X}_{2}(\mathrm{t})=\mathrm{A} ; 0 \leq \mathrm{t} \leq \mathrm{T}$
c. For the system $\mathrm{y}(\mathrm{n})=\mathrm{ax}[\mathrm{n}]+\mathrm{b} x(\mathrm{n}-1)$ determine whether the system is
(i) Linear
(ii) Causal
(iii) Stable
(iv) Time-invariant
(v) Memory less
Q. 3 a. Determine the Fourier's Series representation for signal
$x(t)=\cos (2 \pi t)+4 \sin (6 \pi t)$
b. State and prove the following properties of continuous time and periodic signals
(i) Time shifting
(ii) Time Reversal
c. Find the Fourier Series representation of the signal $x(t)$ shown in fig. 1


Fig. 1
Q. 4 a. State and prove the following properties of continuous signal Fourier Transform:
(i) Time shifting property
(ii) Frequency differentiation property
b. Find the FT of the signal $\mathrm{x}(\mathrm{t})$ as shown in fig. 2


Fig. 2
Q. 5 a. Find a Fourier transformer $x[n]=a^{|n|},|\mathrm{a}|<1$
b. A casual LTI is described by the difference equation
$y[n]=y[n-1]+y[n-2]+x[n-1]$
(i) Find the system function $\mathrm{H}(\mathrm{z})=\mathrm{Y}(\mathrm{z}) / \mathrm{X}(\mathrm{z})$ for this system. Plot the poles and zeros of $\mathrm{H}(\mathrm{z})$ and indicate region of convergence.
(ii) Find the unit sample response of system.
c. For the system equation $y(n)-4 y(n-1),=x(n)$ find
(i) The transfer function and
(ii) Impulse response
Q. 6 a. Find the frequency response of an LTI system having impulse response $h(t)=(1+t) e^{-2 t} u(t)$
b. State and prove sampling theorem for Low pass signal.
c. Determine the Nyquist rate for the following signals
(i) $x(t)=\cos (600 \pi t)+\sin (800 \pi t)$
(ii) $x(t)=\cos (600 \pi t) \cos (800 \pi t)$
Q. 7 a. Find the Laplace transform of the following signals.
(i) $X(t)=t e^{-2 t} u(t)$
(ii) $\mathrm{X}(\mathrm{t})=\mathrm{e}^{-3 t} \cos (5 \mathrm{t}) \mathrm{u}(\mathrm{t})$
b. Find the Inverse Laplace transform of the following X(s)

$$
X(s)=\frac{s+5}{\left(s^{2}+6 s+10\right)}
$$

c. State initial and final value theorem in Laplace transform.
Q. 8 a. Find the Z-transform of the following sequences and find their ROC
(i) $x[n]=\left[\frac{1}{2}\right]^{n-2}\left(\sin \Omega_{0}(n-2)\right) u[n-2]$
(ii) $x[n]=(5)^{n} u[-n-1]-(3\}^{n} u[n]$
b. State and prove the convolution property of Z- transform
c. Find the Inverse Z-transform of
$X(z)=\frac{z}{z^{2}-5 z+6}$
ROC (i) $|z|>3$
(ii) $|z|<2$
(iii) $2<|z|<3$
Q. 9 a. The random variable x is expresses as its density function
$f_{x}(x)= \begin{cases}\alpha e^{-\alpha x} & \mathrm{x}>0 ; \alpha=\text { constan } \mathrm{t} \\ 0 & \text { otherwise }\end{cases}$
Then, find expected values $E[x]$ and $E\left[x^{2}\right]$.
b. What are the properties of wide sense stationary process?
(3)
c. Write properties of power spectral density.

