ROLL NO. _____

Code: AE57/AC57/AT57   **Subject: SIGNALS AND SYSTEMS**

AMIETE – ET/CS/IT

Time: 3 Hours   **JUNE 2014**   **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. For a signal $x(n)$, $x(n+1)$ corresponds to

(**A**) Advance   (**B**) Delay
(**C**) Compression   (**D**) Folding

b. Step function $u(t)$ is obtained from ramp function $r(t)$ by

(**A**) Integrating   (**B**) Differentiating
(**C**) Double Integration   (**D**) Differentiating twice

c. A causal system depends on

(**A**) Past values only   (**B**) Present values only
(**C**) Linear   (**D**) Both (**A**) and (**B**)

d. A signal that violates the first Dirichlet condition i.e. $x(t)$ must be absolutely integrable is

(**A**) t^2 (**B**) t
(**C**) t^3 (**D**) $1/t$

e. The transform of discrete time signal $x(-n)$ will be

(**A**) $X(e^{-j\omega})$ (**B**) $X(e^{j\omega})$
(**C**) $X(e^{-2j\omega})$ (**D**) $X(e^{-3j\omega})$

f. Smoother Interpolation strategies are known as

(**A**) Lower order holds   (**B**) Higher order holds
(**C**) Intermediate order holds   (**D**) Moderate order holds

g. The Frequency response of an LTI system with impulse response $h(t) = e^{-t} u(t)$ is

(**A**) $1/(j\omega + 1)$ (**B**) $1/(j\omega - 1)$
(**C**) $1/(1-j\omega)$ (**D**) $1/(e^{j\omega}+ 1)$

h. Fourier Transform is used to convert from Time domain to frequency domain, the signals which are

(A) Periodic   **(B)** Aperiodic
(C) Both **(A)** and **(B)**   **(D)** None of these

i. Step response of a first order system

(A) Always exhibits Ringing Effect
(B) Does not exhibit Ringing Effect
(C) Sometimes exhibits Ringing Effect
(D) Sometimes does not exhibit Ringing Effect

j. For a signal which is bandlimited to a frequency of 500 Hz, the Nyquist Rate will be

(A) 100 Hz   **(B)** 1000 Hz
(C) 50 Hz   **(D)** 150 Hz

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

Q.2   a. (i) Explain the transformations done on the independent variable   **(4)**

          (ii) Find out the power of the signal x(t) = A sin t   **(4)**

     b. Define unit impulse and unit step functions. Give their relationship.   **(4)**

     c. Define Linearity**.** Find if the following systems are Causal and Linear?   **(4)**
        (i) y(t)= t x(t)
        (ii) y(n)= 2 x(n)+3

Q.3   a. Determine the Fourier Series coefficients of a periodic square wave

$$x(t)=\begin{cases}1 & |t|<T_1 \\ 0 & T_1<|t|<T/2\end{cases}$$ **(8)**

     b. Give the criteria of convergence of continuous time Fourier series.   **(8)**

Q.4   a. Find the Continuous Time Fourier Transform of $x(t)=e^{-at}u(t); a>0$ **(8)**

     b. Prove the Convolution property of CTFT.   **(8)**

Q.5   a. Find the DTFT of $x(n)=a^n u(n)$ **(8)**

     b. Find the frequency response of system that is characterized by the difference equation y (n) - ¾ y(n-1) + 1/8 y(n-2) =2 x(n)   **(8)**

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Q.6   a.   Construct the frequency response of Continuous time ideal low pass filter with that of discrete time ideal low pass filter.   **(8)**

       b.   Explain Sampling Theorem. Define Nyquist rate and Aliasing. Illustrate reconstruction of a continuous time signal from its samples.   **(8)**

Q.7   a.   Find out the Laplace transform of $x(t) = \delta(t) - 4/3 e^{-t} u(t) + 1/3\ e^{2t}\ u(t)$ and sketch the ROC in s-plane.   **(8)**

       b.   Give the properties of ROC of Laplace Transforms.   **(8)**

Q.8   a.   Find the z transform of $x(n) = (1/3)^n\ \sin\left(\dfrac{\pi}{4}n\right)u(n)$ **(8)**

       b.   Explain the scaling property and Differentiation in z domain property of Z transforms.   **(8)**

Q.9   a.   Give the mathematical definition of random process X(t).   **(8)**

       b.   What is a Gaussian Process? Give its properties.   **(8)**