ROLL NO. _____

Code: AE57/AC57/AT57/AE112 **Subject: SIGNALS AND SYSTEMS**

AMIETE – ET *{CURRENT & NEW SCHEME}*

Time: 3 Hours **DECEMBER 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 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. A function f(t) = sin(3t) – cos(5t) is

(A) Periodic **(B)** a periodic
(C) Discrete **(D)** All of these

b. The sample of a cosine wave at zero frequency are equivalent to samples of
(A) a sine wave **(B)** a dc signal
(C) an AC signal **(D)** an unknown signal

c. The fourier series representation of an impulse train denoted by

$s(t) = \sum_{m=-\infty}^{\infty} \delta(t - mT_o)$ is

(A) $\frac{1}{T_o}\sum_{m=-\infty}^{\infty} e^{\frac{j2\pi m}{T_o}t}$ **(B)** $\frac{1}{T_o}\sum_{m=-\infty}^{\infty} e^{\frac{j\pi mt}{T_o}}$

(C) $\frac{1}{T_o}\sum_{m=-\infty}^{\infty} e^{\frac{j4\pi m}{T_o}t}$ **(D)** $\frac{1}{T_o}\sum_{m=0}^{\infty} e^{\frac{j\pi m}{T_o}t}$

d. Fourier transform of $\cos(\omega_o t)$ is

(A) $\frac{1}{2}\delta(f - f_o)$ **(B)** $\frac{1}{2}[\delta(f - f_o) - \delta(f + f_o)]$

(C) $\frac{1}{2}\delta(f + f_o)$ **(D)** $\frac{1}{2}[\delta(f - f_o) + \delta(f + f_o)]$

e. A system represented by $y(t) = x^2(t)$ is
(A) Linear **(B)** Time Invarient
(C) TimeVarient **(D)** Dynamic

f. The process of converting from continuous – time domain to discrete – time domain is called
(A) sampling **(B)** quantization
(C) fourier analysis **(D)** None of these

g. A system is given as $H(z) = \frac{z^2 + 1}{(z + 0.5)(z - 0.5)}$. The initial value is
(A) 0.5 **(B)** 1
(C) 2 **(D)** ∞

h. System represented by $y(n) = 5x(n) + c$ is linear only when.
(A) $C = 0$ **(B)** $C \neq 0$
(C) $C = \infty$ **(D)** $C = -5$

i. The frequency response of discrete- time fourier transform is
(A) Continuous **(B)** Discrete
(C) No frequency response **(D)** None of these

j. A power signal f(t) has power spectral density $S_f(\omega)$. The Power density spectrum of $\frac{df(t)}{dt}$ is
(A) $S_f(\omega)$ **(B)** $\omega^2 S_f(\omega)$
(C) $\omega S_f(\omega)$ **(D)** $\omega^3 S_f(\omega)$

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

Q.2 a. Discuss basic system properties. **(10)**
(i) Time Invarience
(ii) Linearity

b. Show that system represented by **(6)**
$y(t) = x^2(t)$ is non-linear and time invariant.

Q.3 a. Discuss the following properties of continuous time fourier series

(i) Linearity
(ii) Time Reversal
(iii) Time Shifting
(iv) Time Scaling **(10)**

b. Determine the complex exponential fourier series of a square wave x(t) shown in Fig.1 **(6)**

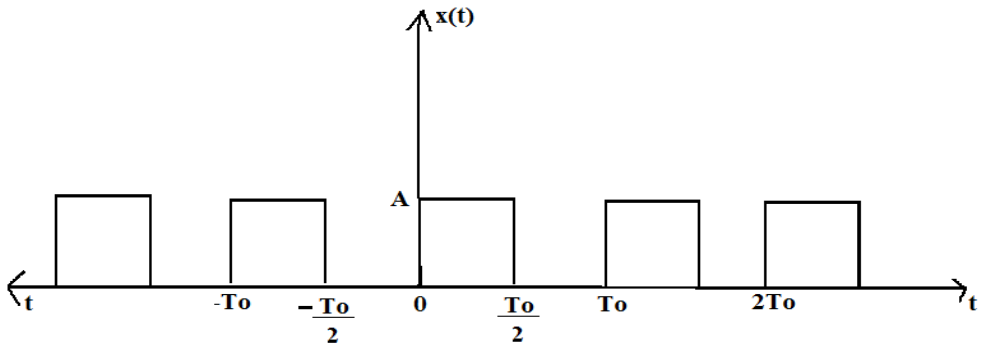

Fig.1

Q.4 a. Determine fourier transform of the signal. $x(t) = e^{-at}u(t)$; $a > 0$. Draw the magnitude and phase plot. **(6)**

b. Discuss conjugation and conjugate symmetry of continuous time fourier transform. Using the symmetry property evaluate the fourier transform of

$x(t) = e^{-a|t|}$, $a>0$. **(10)**

Q.5 a. Determine Discrete time fourier transform of $x(n) = \cos \omega_0 n$. **(6)**

b. Explain the following properties of Discrete-time fourier transform with suitable example. **(10)**

(i) Differencing & Accumulation

(ii) Time Expansion

Q.6 a. Shown in Fig 2 is $|H(j\omega)|$ for a low pass filter. Prove that $h_2(t) = h_1(t-T)$ when $|H_1(j\omega)| = |H_2(j\omega)| = |H(j\omega)|$ and $\angle H_1(j\omega) = 0$, $\angle H_2(j\omega) = \omega T$, T is a constant. **(8)**

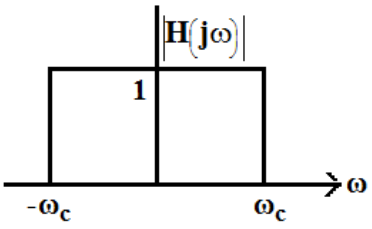

Fig.2

b. Explain Impulse Train Sampling of Discrete Time Signals. **(8)**

Q.7 a. Find Laplace Transform of the following: **(8)**

(i) $x(t) = e^{-2t}u(t) + e^{-t}(\cos 3t)\, u(t)$.

(ii) $x(t) = \delta(t) - \frac{4}{3}e^{-t}u(t) + \frac{1}{3}e^{2t}u(t)$

b. Discuss the following properties of Laplace Transform: **(8)**

(i) Time Shifting
(ii) Convolution
(iii) Time Scaling
(iv) Conjugation

Q.8 a. Determine inverse z transform of the following: **(8)**

$$X(z) = \frac{3 - \frac{5}{6}z^{-1}}{\left(1 - \frac{1}{4}z^{-1}\right)\left(1 - \frac{1}{3}z^{-1}\right)}$$ for the following ROC

(i) $|Z| > \frac{1}{3}$

(ii) $|Z| < \frac{1}{4}$

b. For LTI system, input to the system is $x[n] = \left(\frac{1}{6}\right)^n u(n)$ **(8)**

and output $y[n] = -9\left(\frac{1}{2}\right)^n u(n) + 10\left(\frac{1}{3}\right)^n u(n)$. Determine $H(z) = \frac{Y(z)}{X(z)}$.

Q.9 Discuss the following: **(4×4)**

(i) Random processes
(ii) Stationary processes
(iii) Covariance function
(iv) Power Spectral Density