ROLL NO. _____

Code: AE77/AC77 **Subject: DIGITAL SIGNAL PROCESS**

AMIETE – ET/CS

Time: 3 Hours **DECEMBER 2012** **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. Down sampling by Lowpass filtering followed by compression is termed as

(A) Interpolation **(B)** Aliasing
(C) Decimation **(D)** None of these

b. The relationship between the quantized signal level and the full scale level of the A/D converter

(A) $\Delta = (X_m)/ 2^B$ **(B)** $\Delta = (2\ X_m)/ 2^B$
(C) $\Delta = (X_m)/ 2^{B+1}$ **(D)** $\Delta = (4\ X_m)/ 2^B$

c. Canonical form of structure is

(A) Direct Form I **(B)** Direct Form II
(C) Both **(A)** & **(B)** **(D)** None of these

d. If the continuous time system has poles only in the left half of the s-plane then the discrete time filter must have poles _____

(A) Outside the unit circle only **(B)** Inside the unit circle only
(C) Anywhere on z plane **(D)** $2< |Z|<3$

e. The DFT values are equal to samples of Z transform and are at equally spaced points _____

(A) Outside the unit circle **(B)** Inside the unit circle
(C) On the unit circle **(D)** On entire z plane

f. $W_N^{N/2}$ is equal to

(A) 1 **(B)** $j\omega$
(C) $-j\omega$ **(D)** -1

g. Since Z Transform are analytic functions inside their ROC it means that

(A) They have well defined derivative at every point inside the ROC
(B) Z - Transform and all its derivatives are continuous functions within ROC
(C) Both **(A)** & **(B)**
(D) None of these

h. Relationships between real and imaginary parts of Z - Transform on a closed contour within ROC is referred to as _____

(A) Poisson's formula in mathematical literature
(B) Hilbert Transform relations in system theory
(C) None of these
(D) Both **(A)** & **(B)**

i. Effect of windowing on a signal's spectrum can be.

(A) Reduced Resolution **(B)** Leakage
(C) Both **(A)** & **(B)** **(D)** None of these

j. Out of all the windows available, the one which has the narrowest mainlobe for a given length is

(A) Kaiser window **(B)** Rectangular window
(C) Hamming window **(D)** Hanning window

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

Q.2 a. Explain discrete time processing of continuous time signals. **(8)**

b. Derive the Frequency domain relationship between the input and output of an ideal Continuous to Discrete (C/D) Converter and assist it with spectrum diagrams. **(8)**

Q.3 a. Consider the LTI system with input x [n] and output y [n] are related through the difference equation.

$$y[n] + \frac{1}{4} y[n-1] = x[n] + \frac{1}{2} x[n-1]$$

(i) Find the system function and its ROC **(4)**
(ii) Draw its pole-zero plot **(2)**
(iii) Comment on the causality and stability of this system **(2)**

b. Explain Allpass systems. Obtain its frequency response and discuss the applications of Allpass system. **(8)**

Q.4 a. (i) Obtain the direct form I and direct form II Realization of the system.

$$H(z) = \frac{\left(1 + 2z^{-1} + z^{-2}\right)}{\left(1 - 0.75z^{-1} + 0.125z^{-2}\right)}$$ **(4)**

(ii) Obtain the Linear phase Realization of system given by **(4)**

$$H(z) = \sum_{n=0}^{5} z^{-n}$$

b. Explain Transposition. Give the transposed flow graph of **(8)**

$$H(z) = \frac{1}{\left(1 - az^{-1}\right)}$$

Q.5 a. Explain the design of optimum approximation of FIR filters. **(8)**

b. Differentiate between:
(i) IIR and FIR Filters
(ii) Butterworth filter and Chebyschev filter **(8)**

Q.6 a. Compute the 4 point DFT of the sequence x[n] = {1,j,-1,-j}. **(6)**

b. Prove the statement "Circular Convolution is Linear Convolution with Aliasing" and obtain the Linear convolution of x_1 (n) = {1, 2, 3, 4} and x_2 (n) = {1, -1, 1, -1} using circular convolution. **(10)**

Q.7 a. Explain DIF- FFT Algorithm using signal flow graphs for N=8. Compare its computational complexity with DFT. **(8)**

b. Write a short note on implementation of DFT using Convolution with the help of one example. **(8)**

Q.8 a. Explain the processing steps in discrete time Fourier Analysis of a continuous time signal. **(8)**

b. Elaborate on the Time dependent Fourier Analysis of Non-stationary signals. **(8)**

Q.9 a. Explain Hilbert Transform relationships mentioning how it eliminates the constraints on the Fourier Transform. **(8)**

b. Give the relationship between magnitude and phase of the Fourier transform of a sequence. **(8)**