ROLL NO. _____

Code: AE77/AC77 Subject: DIGITAL SIGNAL PROCESSING

AMIETE – ET/CS (NEW SCHEME)

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **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. In high-speed filtering applications

(A) parallel realization is preferred. **(B)** cascaded realization is preferred.
(C) linear realization is preferred. **(D)** none of the above.

b. Discrete Fourier Transform exists only for signals that are

(A) periodic **(B)** absolutely summable
(C) both **(A)** and **(B)** **(D)** causal

c. The Fourier transform of impulse response of a system is known as its

(A) time response **(B)** frequency response
(C) magnitude response **(D)** phase response

d. If the R is the range of analog quantity to be quantized and b is the binary word size then quantization step size is

(A) R/2b **(B)** $R/2^b$
(C) 2R/ b **(D)** $R^2/2b$

e. Phase response of the Fourier transform of a real signal is

(A) symmetric with frequency **(B)** bounded for positive frequency
(C) anti-symmetric with frequency **(D)** bounded for negative frequency

f. First order LTI system will behave as a _____ filter.

(A) low-pass but not high pass **(B)** high-pass but not low pass
(C) band-pass **(D)** both low pass and high pass

g. Total number of complex additions required in radix-2FFT is

(A) $N \log_2 N$ **(B)** $(N/2) \log_2 N$
(C) $N / (\log_2 N)$ **(D)** none of the above

h. The circular convolution is known as

(A) aperiodic convolution **(B)** linear convolution
(C) periodic convolution **(D)** nonlinear convolution

i. Estimate of power density spectrum is called

(A) auto-correlation **(B)** randomization
(C) periodogram **(D)** spectrogram

j. FIR filter is always stable because all of its pole(s) are

(A) At the origin **(B)** At the infinity
(C) At the ROC **(D)** None of the above

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

Q.2 a. Explain the process of D/A conversion with an example. **(8)**

b. The sequence $x(n)=\cos(n\pi/4)$, $-\infty < n < \infty$; was obtained by sampling a continuous-time signal $x_c(t) = \cos(\Omega_o t)$, $-\infty < t < \infty$; at a sampling rate of 1000 samples/ sec. What are two possible positive values of Ω_o that could have resulted in the sequence x(n)? **(8)**

Q.3 a. Discuss the minimum phase system in detail. **(8)**

b. Determine the frequency response of systems with rational system functions given by $H(z) = \frac{1}{\left(1 - re^{j\theta} z^{-1}\right)\left(1 - re^{-j\theta} z^{-1}\right)}$. Also, plot pole-zero diagram. **(8)**

Q.4 a. What is Transposition? Discuss transposed forms of structures with suitable example. **(8)**

b. Consider a causal LTI system S with impulse response h(n) and system function

$$H(z) = \frac{\left(1 - 2z^{-1}\right)\left(1 - 4z^{-1}\right)}{z\left(1 - 0.5z^{-1}\right)}$$

(i) Draw a direct form II flow graph for the system S.
(ii) Draw the transposed form of the flow graph in part (i). **(8)**

Q.5 a. Discuss the Kaiser Window filter design method. **(6)**

b. Design a Butterworth low-pass filter using Bilinear Transformation concept for the following specifications:

$0.9 \leq |H(e^{j\omega})| \leq 1, \quad 0 \leq |w| \leq 0.2\pi$

$|H(e^{j\omega})| \leq 0.18, \quad 0.3\pi \leq |w| < \pi.$

Assume $T_d = 1$. Also, assume additional data if required. **(10)**

Q.6 a. Write short note: Sampling of Fourier Transform. **(8)**

b. For a sequence x(n) = { **1**, 0.5} and h (n) ={ **0.5**, 1}is given. Obtain linear convolution using DFT. **(8)**

Q.7 a. Define FFT. Also, explain Chirp Transform Algorithm. **(8)**

b. Develop Decimation In Frequency algorithm for N=4 and draw signal flow graph. **(8)**

Q.8 a. Explain Fourier analysis of stationary random signal. **(8)**

b. Discuss the time-dependent Fourier Transform with a suitable example. **(8)**

Q.9 a. Explain with an example how bandpass signals are represented using Hilbert transform. **(8)**

b. Explain the Kaiser Window design of Hilbert Transformer. **(8)**