ROLL NO. _____

Code: AE77/AC77 Subject: DIGITAL SIGNAL PROCE

AMIETE – ET/CS

Time: 3 Hours **JUNE 2013** **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. Z transform of $\delta(n)$ is

(A) Z^{-n} **(B)** 1
(C) $1/z$ **(D)** $1/(1-z)$

b. The group delay is defined as the

(A) Negative of the derivative of phase
(B) Derivative of phase
(C) Positive of the derivative of phase
(D) Integral of phase

c. For causal FIR systems the system function has

(A) All poles at origin **(B)** Only poles
(C) Poles and zeros both **(D)** none of these

d. In Impulse Invariance design procedure the relationship between continuous time and discrete time frequency is

(A) Non-linear **(B)** Parabolic
(C) Linear **(D)** Exponential

e. The DFT of a product of two N point sequences is ---------- of their respective discrete Fourier Transforms.

(A) Linear Convolution **(B)** Circular Convolution
(C) Multiplication **(D)** Integral

f. Goertzel's algorithm requires computation proportional to

(A) N **(B)** 2N
(C) (N+1) **(D)** N^2

g. Hilbert Transformer is also known as

(A) 90° phase shifter **(B)** 180° phase shifter
(C) 270° phase shifter **(D)** 360° phase shifter

h. An all pass system is for which the frequency response magnitude is

(A) Decreasing **(B)** Increasing
(C) Constant **(D)** Exponential

i. This has an equiripple characteristics in the passband and varies monotonically in the stopband

(A) Type I Chebyshev filter **(B)** Type II Chebyshev filter
(C) Butterworth filter **(D)** Elliptical filter

j. The wideband spectrogram results from a window that is short in time and characterized by

(A) Poor Resolution in frequency dimension and good Resolution in time dimension.
(B) Good Resolution in frequency dimension and poor Resolution in time dimension.
(C) Poor Resolution in frequency dimension and poor Resolution in time dimension.
(D) Good Resolution in frequency dimension and good Resolution in time dimension.

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

Q.2 a. Explain D/A Conversion in detail. **(8)**

b. Explain how can we reconstruct the CT band limited signal from its samples. **(8)**

Q.3 a. The Difference Equation of a causal discrete time LTI system is given as

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

(i) Find the frequency response $H(e^{j\omega})$ for the system.

(ii) Find the output response of this system to the input $x(n) = (1/2)^n u(n)$ **(8)**

b. (i) What are Inverse systems? **(2)**
(ii) Explain minimum phase systems and discuss their unique fundamental properties. **(6)**

Q.4 a. Obtain the direct form I and direct form II realization of

$$H(z)=\frac{3+3.6z^{-1}+0.6z^{-2}}{1+0.1z^{-1}-0.2z^{-2}}$$ **(8)**

b. Obtain the cascade and parallel form of realization for

$$H(z)=\frac{\left(1-z^{-1}\right)^3}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{8}z^{-1}\right)}$$ **(8)**

Q.5 a. Explain the design of IIR filters using Bilinear transformation with the help of one example. **(8)**

b. Explain Equiripple Approximations for a type I FIR Filter. **(8)**

Q.6 a. If $x[n]=\cos\left(\frac{\pi n}{2}\right)$, Find the 4 point DFT X(k). **(8)**

b. Explain the linearity and circular convolution property of DFT for a finite duration sequence. **(2×4)**

Q.7 a. Explain DIT- FFT Algorithm using signal flow graphs for N=8. Hence find DFT of sequence [1 -1 1 -1 1 -1 1 -1] using DIT-FFT algorithm. **(8)**

b. Explain linear filtering approach to compute DFT. **(8)**

Q.8 a. Discuss the Fourier analysis of non-stationary signals. **(8)**

b. Elaborate on computing correlation and Power Spectrum estimates using DFT. **(8)**

Q.9 a. Consider a real, causal sequence x[n] for which $X_R(e^{j\omega})$, the real part of DTFT is $X_R(e^{j\omega}) = 1+ \cos 2\omega$. Determine the original sequence x[n], its Fourier transform $X(e^{j\omega})$ and the imaginary part of Fourier transform $X_I(e^{j\omega})$. **(8)**

b. Explain Hilbert Transform relations for complex sequences. **(8)**