ROLL NO. ____________

Code: AE77/AC77 Subject: DIGITAL SIGNAL PROC

AMIETE – ET/CS

Time: 3 Hours

DECEMBER 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. One to one mapping is obtained using

(A) Impulse invariance mapping **(B)** Bilinear mapping
(C) Both **(A)** and **(B)** **(D)** None of these

b. Delay distortion

(A) shift the sequence in frequency **(B)** shift the sequence in phase
(C) shift the sequence in time **(D)** shift the sequence in magnitude

c. The direct Form - II realization requires ______ memory than the Direct Form -I realization.

(A) more **(B)** less
(C) same **(D)** can not decide from given data

d. If the continuous time signal is $x_c(t) = \cos(16000\pi t)$ with sampling period $T = 1/6000$, will result in

(A) inequality **(B)** aliasing
(C) interpolation **(D)** recovery without aliasing

e. In overlap add method ___________ is performed.

(A) circular convolution **(B)** linear convolution
(C) Zero padding **(D)** Both **(B)** and **(C)**

f. Window methods are used for

(A) low pass filter **(B)** high pass filter
(C) Linear-phase low pass filter **(D)** All of these

g. For DIT and DIF algorithms

(A) They involves same number of computations
(B) They requires bit reversing

(C) They require multiplication of phase factor
(D) All of these

h. Time dependent Fourier Transform can be analyzed using

(A) Overlap save method **(B)** Overlap add method
(C) Both **(A)** & **(B)** **(D)** None of these

i. Estimation of power density spectrum is called

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

j. An ideal Hilbert transformer is _______ that imparts a___ phase shift on the input signal

(A) an all-pass filter, 90° **(B)** an all-pass filter , - 90°
(C) a low-pass filter, 90° **(D)** a low-pass filter, - 90°.

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

Q.2 a. Define Quantization. Derive the signal-to-quantization noise ratio for sinusoidal signals. **(8)**

b. In the system shown in Fig.1, $X_c(j\Omega)$ and $H(e^{j\omega})$ are as shown **(8)**

and $1/T_1 = 30000$, $1/T_2 = 10000$ respectively.

Sketch and label the Fourier transforms of $y_d[n]$ and $y_c(t)$.

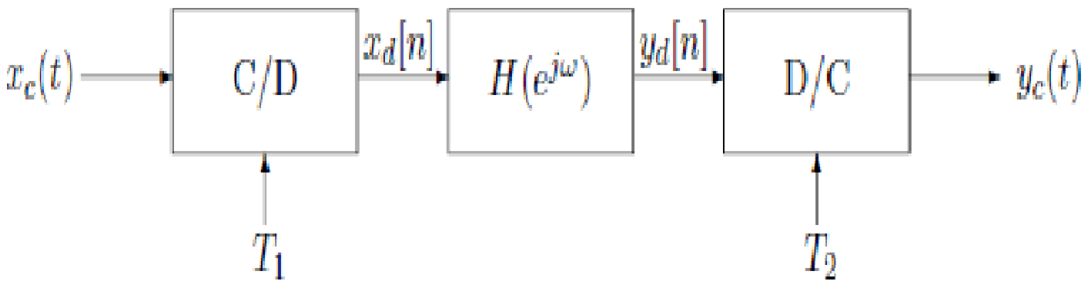

Fig.1

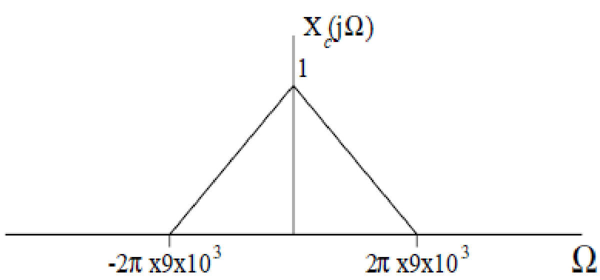

Fig.2

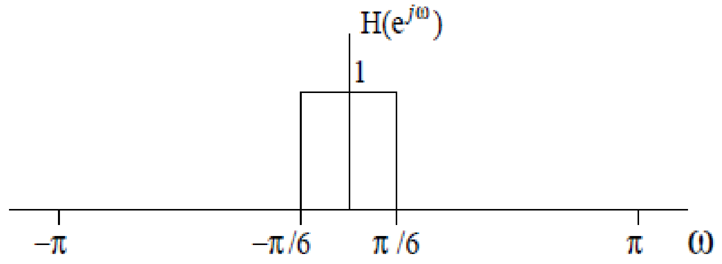

Fig.3

Q.3 a. Consider the LTI system with input x[n] and output y[n], which are related through the difference equation: $y[n] - 5/2\, y[n-1] + y[n-2] = x[n]$

(i) Obtain 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. A discrete-time causal LTI system has the system function

$$H(z) = \frac{(1+0.2z^{-1})(1-9z^{-2})}{(1+0.81z^{-2})}$$

Find expression for a minimum-phase system $H_1(z)$ and an all- pass system $H_{ap}(z)$ such that $H(z) = H_1(z)\, H_{ap}(z)$. **(8)**

Q.4 a. Obtain the parallel-form structure of the given H(z) for first-order and second order systems.

$$H(z) = \frac{\left(1+2z^{-1}+z^{-2}\right)}{\left(1-0.75z^{-1}+0.125z^{-2}\right)}$$ **(8)**

b. Describe the signal flow graph representation of linear constant coefficient difference equations. **(8)**

Q.5 a. With an example, design a differentiator using Kaiser Window concept. **(8)**

b. Discuss the Parks- McClellan algorithm for type I low pass filter. **(8)**

Q.6 a. Discuss and prove the following properties of Discrete Fourier Transform. **(8)**
(i) Duality (ii) Symmetry

b. Perform the Circular Convolution of the two sequences $x_1(n) = \{\underline{\mathbf{2}}, 1, 2, 1\}$ and $x_2(n) = \{\underline{\mathbf{1}}, 2,3,4\}$. **(8)**

Q.7 a. For x(n) = (1,1,-1,-1) use 4-point DIT, algorithm for FFT and cross check the result using DFT. **(8)**

b. Write a short note on implementation of DFT using “The Chirp Transform Algorithm.” **(8)**

Q.8 a. Discuss the effect of windowing on Fourier analysis of sinusoidal signals. **(8)**

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

Q.9 a. Explain usages of Hilbert Transform for band pass signals. **(8)**

b. For a real, causal sequence x(n) for which $X_R(e^{jw}) = \frac{5}{4} - \cos\omega$. Obtain

(i) The original sequence x(n) and

(ii) Imaginary part of the Fourier transform $X_I(e^{jw})$. **(8)**