ROLL NO. _____

Code: AE77/AC77/AE121 **Subject: DIGITAL SIGNAL PROCESSING**

AMIETE – ET/CS (Current & New Scheme)

Time: 3 Hours **June 2019** **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. The system $y(n) = |x(n)|$ is

(A) Static, non-linear, causal, time-invariant
(B) Dynamic, linear, causal, time-invarient
(C) Static, linear, causal, time-invarient
(D) Static, linear, causal, time-varient

b. A digital signal is

(A) Continuous in time, discrete in amplitude
(B) Discrete in time , continuous in amplitude
(C) Continuous in time, continuous in amplitude
(D) Discrete in time, discrete in amplitude

c. What kind of filter is an ideal Hilbert transformer?

(A) Low pass **(B)** High pass
(C) Band pass **(D)** All pass

d. The speed improvement factor involved in the direct evaluation of DFT vs FFT algorithm, for N= 256 is

(A) 32 **(B)** 128
(C) 256 **(D)** 64

e. Parallel form of realization is done in

(A) High speed filtering applications **(B)** Low speed filtering applications
(C) Both **(A)** and **(B)** **(D)** None of these

f. DFT is applied to

(A) Infinite sequences **(B)** Finite discrete sequences
(C) Continuous Infinite signals **(D)** Continuous finite sequences

g. Which of the following windows gives a lowpass filter with high transition band

(A) Rectangular window **(B)** Triangular window

(C) Hamming window **(D)** Blackman window

h.The Fourier transform of a conjugate symmetric function is always

(A) Imaginary **(B)** Conjugate anti-symmetric

(C) Real **(D)** Conjugate symmetric

i. The 4 point DFT of {1, 1, 0, 0} is

(A) $\{2,0,2,0\}$ **(B)** $\{0,4,0,0\}$

(C) $\{2,1+j2,-2,1-j2\}$ **(D)** $\{2,1-j,0,1+j\}$

j. The condition on impulse response for a linear phase FIR filter is

(A) $h(n)=h(N-1)$ **(B)** $h(n)=h(N-n)$

(C) $h(n)=h(N-1-n)$ **(D)** $h(n)=-h(N-n)$

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

Q.2 a**.** What is need of FFT algorithm? Explain the computational requirements involved in radix 2 FFT algorithm. **(4)**

b. A designer has a number of 8 point FFT chips. Show explicitly, how he should interconnect three such chips in order to compute a 24 point DFT? **(8)**

c. What is meant by radix-2 FFT? **(4)**

Q.3 a. By means of DFT and IDFT determine the response of FIR Filter with impulse response h(n)={1, 2, 3} to the input sequence x(n)={1, 2, 2, 1}. **(6)**

b. Compute Fourier Transform X(w) and the six point DFT X(K) of the signal x(n)={3, 2, 1, 0, 1, 2} (**6)**

c. Compute linear and circular convolutions for the following using graphical method. x(n) = [0, 1, 1, 2], h(n) = [-1, 2, 3] **(4)**

Q.4 a. Use the Bilinear transformation to convert the analog filter with the system function. $H(s)=\dfrac{s+0.1}{(s+1)(s+1)+9}$ into a digital IIR filter. Select T= 0.1 and compare the location of the zeros obtain by applying the Impulse Invariance method in the conversion of H(s). **(8)**

b. Design an FIR filter to meet the following specifications. Pass band edge = 2 kHz, Stop band edge = 5 Hz, Stop band attenuation= 42 db, Sampling frequency=20Hz **(8)**

Q.5 a. Realize the following IIR system by cascade and parallel forms **(8)**

$$y(n)+\frac{y(n-1)}{4}-\frac{y(n-2)}{8}=x(n)-2x(n-1)+x(n-2)$$

b. For the given linear phase filter determine the number of delays and adders used in (i) direct farm (ii) cascade (iii) linear phase type I (iv) linear phase type II **(8)**

Q.6 a. Determine the range of values of the parameter ***a*** for which the LTI system with impulse response $h(n)=a^n u(n)$ is stable. **(6)**

b. What are the different types of operations performed in discrete time signals? **(4)**

c. By direct evaluation of convolution sum, determine the setp response of an LTI system. Whose impulse response is $h[n]=a^{-n}\,u[n]$, $0 < a < 1$ **(6)**

Q.7 a. Using Discrete Fourier Transform, determine **(8)**
(a) Circular Convolution
(b) Linear Convolution
For $x_1[n]=\cos(2\pi/N)n$, $x_2[n]=\sin(2\pi/N)n$, $0\le n\le N-1$

b. Explain with example overlap add and overlap save method to compute periodic convolution. **(8)**

Q.8 Consider the analog signal $X_a(t)=3\cos(100\pi)t$

(a) Determine the minimum sampling rate required to avoid aliasing**.** **(2)**
(b) Suppose that the signal is sampled at the rate F_s= 200 Hz . What is the discrete time signal obtain after sampling? **(4)**
(c) Suppose that the signal is sampled at the rate F_s= 75 Hz . What is the discrete time signal obtain after sampling? **(4)**
(d) What is the freq. of sinusoids that yields samples identical to those obtain in part-c? **(6)**

Q.9 a. A discrete system is given by the following difference equation $y(n)-5y(n-1)=4x(n-1)+x(n)$, where *x(n)* is input and *y(n)* is output. Determine its magnitude and phase response as a function of frequency. **(8)**

b. Find Hilbert transform of (i) $e^{j\omega t}$ (ii) $\frac{\sin t}{t}$ **(8)**