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

AMIETE – ET/CS (Current & New Scheme)

Time: 3 Hours   **DECEMBER 2018**   **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. Which mathematical notation specifies the condition of periodicity for a continuous time signal?
   (A) x(t) = x(t+To)   **(B)** x (n) = x(n +N)
   (C) x(t) = e^{-αt}   **(D)** x(t) = x(t-To)

b. Double sided phase of amplitude spectra
   (A) Possess an odd & even symmetry respectively
   (B) Possess an even & odd symmetry respectively
   (C) Both possess an odd symmetry
   (D) Both possess an even symmetry

c. Duality property of Fourier transform states that
   (A) Shape of signal and spectrum in frequency domain can be inter changeable
   (B) Shape of signal and spectrum in time domain can be inter changeable
   (C) Shape of signal and spectrum in time domain can never be inter changeable
   (D) Shape of signal and spectrum in frequency domain can never be inter changeable

d. What is the possible range of frequency spectrum for discrete time Fourier series?
   (A) 0 to 2π **(B)** $-\pi$ to π
   (C) Both **(A)** & **(B)**   **(D)** -2π to 2π

e. What is the frequency response of a system with input h(n) and window length of M ?
   (A) $\sum_{n=0}^{m-1} h(n)\, e^{j\omega n}$ **(B)** $\sum_{n=0}^{m} h(n)\, e^{j\omega n}$
   (C) $\sum_{n=0}^{m} h(n)\, e^{-j\omega n}$ **(D)** $\sum_{n=0}^{m-1} h(n)\, e^{-j\omega n}$

f. The DFT of δ(n) is
   (A) 2π **(B)** π
   (C) 1   **(D)** 0

g. For a Kaiser window the width of main lobe is
   (A) $4\pi/N$ **(B)** $8\pi/N$
   (C) $12\pi/N$ **(D)** Adjustable

h. which block of the discrete time systems require memory in order to store the previous input?
    (A) Adder   **(B)** Signal Multiplier
    (C) Unit Advance   **(D)** Unit delay

i. The condition for impulse response to be anti symmetric is
    (A) $h(n) = -h(N-1-n)$ **(B)** $h(n) = h(-n)$
    (C) $h(n) = h(N-1-n)$ **(D)** All these

j. In FIR filter design, which among the following parameters is /are separately controlled by using Kaiser window?
    (A) Order of filter (N)   **(B)** Transition width of main lobe
    (C) Both **(A)** and **(B)**   **(D)** None


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

Q.2   a. Explain the digital processing of analog signal.   **(8)**

      b. Consider the analog signal $x(t) = 5\cos100\pi t$. Suppose the signal is sampled at the rate $F_{s1} = 150Hz$ and $F_{s2} = 400Hz$. What is the discrete time signal obtained after sampling? **(8)**

Q.3   a. Find the impulse response of the systems described by the difference equation
       $y(n)-3y(n-1)-4y(n-2) = x(n)+ 2x(n-1)$
       Also find the system transfer function H(Z).   **(12)**

      b. Explain all pass systems**.**   **(4)**

Q.4   a. Obtain the direct form I and direct form II realizations of a system governed by the equation
       $y(n) = -\frac{3}{8}y(n-1) + \frac{3}{32}y(n-2) + \frac{1}{64}y(n-3) + x(n) + 3x(n-1) + 2x(n-2)$ **(12)**

      b. Draw the network structures for FIR systems.   **(4)**

Q.5   An 8 point sequence is given by $x(n) = \{1,1,1,1,1,1,0,0\}$; compute its 8 point DFT by
       (a) Radix 2 DIT FFT Algorithm   **(8)**
       (b) Radix 2 DIF FFT Algorithm   **(8)**

Q.6   **a.** Using Impulse invariance method, with T = 1 sec, determine H(Z) if
       $H(S) = \dfrac{1}{s^2 + \sqrt{2}\, s + 1}$ **(10)**

b.   An interconnection of LTI system is   **(6)**
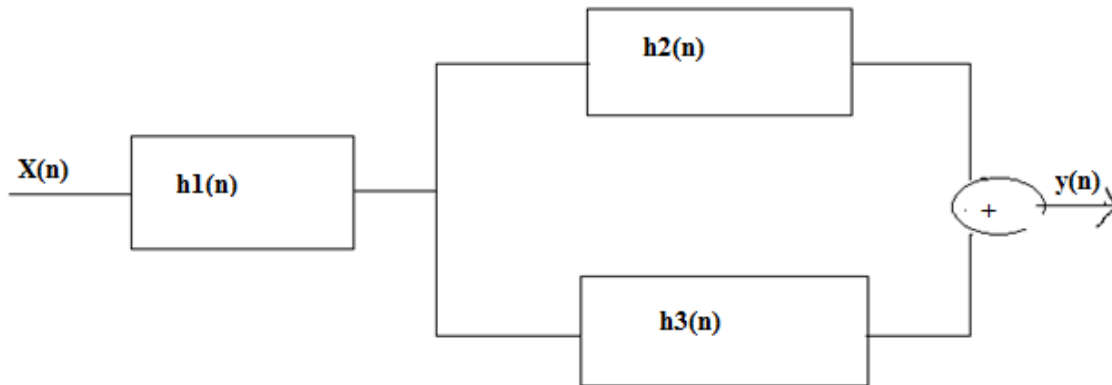
The impulse response $h_1(n) = (1/2)^n u(n)$ $h_2(n) = u(n)$ $h_3(n) = u(n-4)$ evaluate H(n)

Q.7   For the desired response
$H_d (e^{j\omega}) = e^{-j\omega}$, $-\pi/8 \le |\omega| \le \pi/8$
        $= 0$, $\pi/8 \le |\omega| \le \pi$
Determine $H_d(e^{j\omega})$ for N = 7 and compare the response for
(a) Rectangular window
(b) Hanning window
(C) Hamming window   **(16)**

Q.8   a. Find the linear convolution of the two finite sequences $x_1(n) = \{0,1,2,3,4\}$ and $x_2(n) = \{0,1\}$ **(6)**

        b. Sate and prove any four properties of Discrete Fourier transform.   **(10)**

Q.9   a. Explain periodogram.   **(6)**

        b. Give the Hilbert transform relations for complex sequences.   **(10)**