ROLL NO. _____

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

AMIETE – ET/CS (Current & New Scheme)

Time: 3 Hours **DECEMBER 2015** **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. Determine the convolution sum of two sequences $x(n)=\{3,2,1,2\}$ and $h(n)=\{1,2,1,2\}$

(A) $y(n)=\{3,8,8,12,9,4,4\}$ **(B)** $y(n)=\{3,8,3,12,9,4,4\}$

(C) $y(n)=\{3,8,8,12,9,1,4\}$ **(D)** $y(n)=\{3,8,8,1,9,4,4\}$

b. Sampling theorem is:

(A) $f_m < f_s$ **(B)** $f_m > f_s$

(C) $f_s >= 2f_m$ **(D)** $f_s = 2f_m$

c. Twiddle factor is:

(A) $W = e^{-i\left(\frac{2\pi}{N}\right)}$ **(B)** $W = e^{i\left(\frac{2\pi}{N}\right)}$

(C) $W = e^{-i\left(\frac{\pi}{2N}\right)}$ **(D)** None of these

d. The minimum sampling frequency for $x_a(t)$ is real with $X_a(f)$ non-zero only for 9 KHz < |f| <12 KHz is

(A) 4.5 KHz **(B)** 6 KHz

(C) 9 KHz **(D)** 12 KHz

e. Advantages of DSP are:

(A) low cost **(B)** stable

(C) reliable **(D)** All of these

f. A DSP convolves each discrete sample with four coefficients and they are all equal to 0.25. This must be a

(A) low-pass filter **(B)** high-pass filter

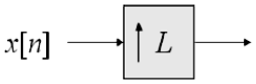
(C) band-pass filter **(D)** band-stop filter

g. Coefficient symmetry is important in FIR filters because it provides
(A) a smaller transition bandwidth
(B) less passband ripple
(C) less stopband ripple
(D) a linear phase response

h. Which of the following is used to alter FIR filter coefficients so they smoothly approach zero at both ends?
(A) Rectangular window **(B)** Blackman window
(C) Laplace window **(D)** Hilbert window

i. FIR filters are_____generally as sensitive to coefficient round off.
(A) not **(B)** less
(C) most **(D)** None of these

j. This block represents



(A) Up-sampler **(B)** down sampler
(C) Both **(A)** & **(B)** **(D)** None of these

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

Q.2 a. Determine the values of power and energy of the following signals. Find whether the signals are power or energy signal.

$$x(n)=\left(\frac{1}{3}\right)^n u(n)$$ **(8)**

b. Determine if the system described by the following equation is **(8)**
(i) causal or non-causal
(ii) linear or nonlinear.

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

Q.3 a. Find y(n) if $x(n)=n+2$ for $0\le n\le 3$ and h(n) =a^nu(n) for all *n*. **(8)**

b. Write the advantages, disadvantages and application of Digital Signal Processing. **(8)**

Q.4 a. Determine the solution of the differential solution

$y(n)=\frac{5}{6}y(n-1)-\frac{1}{6}y(n-2)+x(n)$ for $x(n)=2^n u(n)$. Assume the system is initially relaxed. **(8)**

b. State and Prove the Parseval's Theorem. **(8)**

Q.5 a. Determine the magnitude response of $y(n)=\frac{1}{2}[x(n)+x(n-2)]$. **(8)**

b. For the following system, determine whether or not the system is time invariant.

$y(n)=\sum_{k=0}^{m}a(k)x(n-k)-\sum_{k=1}^{n}b(k)y(n-k)$. **(8)**

Q.6 a. Find the z- transform and the ROC of the signal $x(n)=-b^{n}u(-n-1)$. **(8)**

b. Find the DFT of a sequence $x(n)=\{1,\ 1,\ 0,\ 0\ \}$. **(8)**

Q.7 a. Determine the direct form II and Transposed direct form II for the given system

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

b. (i) Explain the procedure of designing digital filters from analog filters. **(4)**
(ii) Mention any two procedures for digitizing the transfer function of an analog filter. **(4)**

Q.8 a. Find the IDFT of the sequence $X(k)=\{10,\ -2+j2,-2,\ -2-j2\}$. **(8)**

b. Determine the order of lowpass. Butterworth filter that has a 3dB attenuation at 500Hz and an attenuation of 40dB at 1000Hz. **(8)**

Q.9 a. Explain Hibbert transform relations for complex sequences with suitable illustrations. **(8)**

b. Find the inverse Z-transform of

$X(z)=\frac{z^{-1}}{3-4z^{-1}+z^{-2}}$; ROC $|z|>1$ **(8)**