COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra)

End Semester Examination

(DE - 09024) Signals and Systems

Programme: T. Y. B. Tech (Instrumentation and Control)

Year: 2013-14 Semester: I

Duration: 3 hrs Max. Marks: 60

Instructions:

1. Solve any **THREE** questions.
2. Assume suitable data if necessary.
3. Figures to right indicate full marks.
4. Draw neat figures wherever required.
5. Use of non-programmable calculator is allowed.

Q.1 Answer the following:

A) Determine whether the following system is linear, stable, causal and time-invariant using appropriate tests:

$y(n) = nx(n) + x(n+2) + y(n-2)$ [8]

B) What is FFT? Draw and explain in detail Decimation in frequency (DIF) FFT algorithm for 8 point data. [8]

C) Choose appropriate choice(s): [4]

1. What is the condition for perfect reconstruction of an analog signal from its Discrete signal?
   a. the signal should be band limited
   b. the signal should have all frequency components
   c. signal should contain high frequency
   d. none

2. If x(n)={.... -2,-4,2,0,5,7,.....} .Then
   ↑
   what is the value of x(2)?
   a) –2
   b) –4
   c) 0
   d) 5

3. What are the specifications that are needed to completely describe a filter?
   a) pass band ripple, stop band ripple ,Ws, Wp
   b) pass band ripple, stop band ripple , Wp only
   c) pass band ripple, stop band ripple
   d) Ws, Wp

4. The signal which exists only at t =0, whose area is unity referred as continuous

time unit
a) Impulse b) Time
c) Series d) Level

Q. 2 Answer the following:

A) Obtain the convolution of the following sequences:

$x_1(n) = (1, 2, \underset{\uparrow}{1}, 2, 1)$

$x_2(n) = (0, 1, 2)$

Use graphical approach. [6]

B) Find inverse discrete Fourier transform the following:

$X(k) = (2, 2+2j, -2, 2-2j)$ [8]

C) The input and the output of a causal LTI system are related by the differential equation.

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = x(t)$$

a) Find the impulse response of the system.

b) What is the impulse response of the system if $x(t) = te^{-4t}u(t)$ [6]

Q. 3 Answer the following:

A) What is sampling theorem? How is it important in signal processing? Elaborate with proper illustration. [4]

B) Find the inverse Z transform of

$$X(z) = \frac{3z^{-1}}{(1-z^{-1})(1-2z^{-1})}$$

a) If ROC; $|z| > 2$

b) If ROC ; $|z| < 1$

c) If ROC; $1 < |z| < 2$ [6]

C) Choose appropriate choice(s): [5]

1. For the analog signal given below

$m(t) = 4\cos 100\pi t$, then the value of Fs is

a) 1000 Hz b) 10 KHz
c) 100 Hz d) 10000 Hz

2. Z transform of sequence x[n] = { 8, 7, 2, 0, 0, -5 } where x[0] = 2 , is

a) $8Z^2 + 7Z + 2 - 5Z^{-3}$
b) $8Z^{-2} + 7Z^{-1} + 2 - 5Z^3$
c) $8Z^2 + 7Z + 2 - 5Z^{-1}$

3. What is the condition for linearity?

a) T[a1*x1(n)+a2*x2(n)]
= a1* T[x1(n)] + a2*T[x2(n)]
b) T[a1*x1(n)+a2*x2(n)]=x1(n)+x2(n)
c) T[a1*x1(n)+a2*x2(n)]
= T[x1(n)] + T[x2(n)]
d) T[a1*x1(n)+a2*x2(n)]
= T[a1*x1(n)] + T[a2*x2(n)]

4. The sampling theorem was given by _____ in 1928.
a) Shannon
b) Nyquist
c) Oppenheim
d) Schfer

5. For a system to be completely characterized by its impulse response h(n) it has to be
a) linear
b) stable
c) causal
d) LTI

D) Consider recursive relation
$y(n) = 3y(n-1) + y(n-2) + 5x(n) - 2x(n-1)$
Obtain its non-canonical form and canonical form implementation. [5]

Q. 4 Answer the following:

A) You are required to design and realize audio processing application, suggest a suitable scheme required for realization and explain in detail. [5]

D) Find the Z Transform of the signal
$$x(n) = n\left[\left(\frac{1}{2}\right)^n u(n) * \left(\frac{1}{3}\right)^n u(n)\right]$$ [6]

B) Compare analog and digital filters [2]

C) Choose appropriate choice(s): [3]
1. If $X(w)= e^{-jw}$ then what is x(n)?
a. $\delta(n)$
b. $\delta(n-1)$
c. $\delta(n+1)$
d. $\delta(n+4)$

2. If $x1(n) \leftrightarrow X1(w)$ and $x2(n) \leftrightarrow X2(w)$ then what is the fourier transform of [x1(n)]*[x2(n)]?
a. X1(w).X2(w)
b. X1(w)/X2(w)

c. X1(w) +X2(w)
d. X1(w) – X2(w)

3. Mathematically discrete time unit impulse can be obtained as

a) $\delta[n] = u[n]$ b) $\delta[n] = u[n] - u[n-1]$
c) $\delta[n] = u[n] + u[n+1]$ d) $\delta[n] = u[n] - u[n-2]$

D) Find whether the signal

$$x(t) = \begin{cases} t-2 & -2 \le t \le o \\ 2-t & 0 \le t \le 2 \\ 0 & otherwsie \end{cases}$$

is energy signal or power signal. Also find the energy and power of the signal. [4]

*******All the Best*******