Suggestion on DSP

(Multiple Choice Questions)

1. Choice the correct alternatives any ten of the following: 10x1=10

i) An analog signal is expressed by the equation- $x(t) = 3\cos 50\pi t + 10\sin 300\pi t - \cos 100\pi t$.
   The Nyquist rate of the signal is-

a) 150Hz   b) 300Hz   c) 25Hz   d) 50Hz

ii) The convolution of u(n) with u(n-4) at n=5 is-
      a) 5   b) 1   c) 2   d) 0

iii) The ROC of the z-transform of a causal sequence is-

a) the interior of a circle
b) the exterior of a circle
c) a rectangle
d) an annular region

iv) In FFT, for calculating N-point DFT total number of complex addition required is

a) N^2 b) $(N-1)\log_2 N$ c) $\dfrac{N}{2}\log_2 2N$ d) $N\log_2 N$

v) If X(z)=Z{x(n)}, then Z{nx(n)} is equal to-

a) $X\dfrac{dX(z)}{dz}$ b) $-X\dfrac{dX(z)}{dz}$ c) $X^{-1}\dfrac{dX(z)}{dz}$ d) $-X^{-1}\dfrac{dX(z)}{dz}$

vi) During FFT calculations using DIF algorithm,
   a) outputs are in bit reversal form
   b) inputs are taken in bit reversal form
   c) both input and output are taken in bit reversal form
d) none of these through the plane

vii) Impulse invariant method of digital filter design can be used to design
   a) low pass filter
   b) high pass filter
   c) any type of filter
   d) FIR filter

viii) FIR filter is of
   a) Non recursive and non linear type
   b) Non recursive and linear type
   c) Recursive and non linear type
   d) Recursive and linear type

ix) If a discrete-time signal is anti-causal, then ROC will include-
   a) Z=0   b) z=∞   c) z=0 and z=∞
   d) none of these

x) Zero padding a signal
   a) reduces aliasing
   b) increases time resolution
   c) increase frequency resolution
   d) has no effect

xi) The system having input x (n) related to output $y(n) = \log_{10}|x(n)|$ is
   a) non linear, causal, BIBO stable.
   b) linear, non causal, BIBO stable.
   c) linear, non causal, BIBO unstable.
   d) non linear, causal, BIBO unstable.
   e)
xii) For normal DFT calculations number of complex multiplications required is-
   a) N   b) 2N   c) $2N^2$ d) N^2

(Short Answer Questions)

Answer any three of the following: **3*5=15**

2. Calculate the power and energy of the following signal and comment about the type of the signal

$$x (n) = r(n) - r(n-5)$$ 5

3. Find the IFFT using of (1,1,1,1) using DIF algorithm.

                                                                            5

4. Determine the inverse Z Transform of following sequence using property of z-transform

$$X(z) = \log(1 - 0.5z^{-1}), \ |z| > 0.5$$ 5

5. a) Represent the sequence   x(n) = {4,2,-3,5,2,6,8,1} as a sum of shifted impulse function.

b) If the $x(n) = \begin{cases} 1 & for\ 0 \le n \le 3 \\ 0 & elsewhere \end{cases}$, then sketch the signal $y_1(n) = x(n-2)$. 2.5+2.5
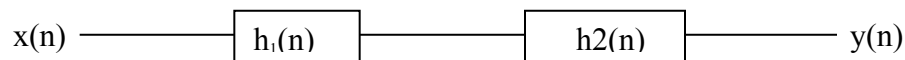
6. Compute the DFT of a sequence $(-1)^n$ for N=4. 5

(Long Answer Questions)
Answer any three of the following: 3*15=45

7. a) An interconnection of LTI systems is shown below. The impulse responses are $h_1(n) = (1/2)^n [u(n) - \delta(n)]$ and $h2(n) = u(n-3)$. Let the impulse response of the overall system from x(n) to y(n) be denoted as h(n). Evaluate h(n).

x(n) ——————| $h_1(n)$ |——————————| h2(n) |—————— y(n)

b) Find the output y(n) of a filter whose impulse response is h(n)={1,1,1} and the input signal x(n) = {3,-1,0,1,3,2,0,1,2,1} using Overlap-add method.
c) Check the following system is linear or not: $y(n)=nx^2(n)$. Also check the time invariance of the above system. 5+6+3

8. a) Using residue method, find the inverse z-transform of
$$X(z) = \frac{z+1}{(z+0.2)(z-1)}, |z|>1.$$

b) Determine the z-transform and ROC of the following discrete-time signal:
$$x(n) = \left(-\frac{1}{5}\right)^n u(n) + 5\left(\frac{1}{2}\right)^{-n} u(-n-1)$$

c) If $Y(z) = \frac{0.5(1-0.5z^{-1})}{(1-0.25z^{-1})(1-0.75z^{-1})(1-z^{-1})}$, find the steady-state value of y(n) if it exists. 5+6+3

9. a) what are the differences between IIR and FIR filter.
b) Compare bilinear transformation method over impulse invariance method.
c) Design a Butterworth filter the bilinear transformation for the specifications
$$0.8 \le |H(e^{j\omega})| \le 1, \quad 0 \le \omega \le 0.2\pi$$
$$\le |H(e^{j\omega})| \le 0.2, \quad 0.6\pi \le \omega \le \pi$$
  3+3+8

10. a Given $x(n) = 2^n$ and N=8, find X(k) using DIT-FFT algorithm

b) Prove the symmetry property and periodicity property of the twiddle factor .

c) Establish relation between z-transform and Fourier transform.   8+4+2

12. Write short notes on (any three):-   3x5=15
   a) Gibbs phenomenon
   b) Linear Convolution using Circular Convolution.
   c) Warping effect & Prewarping.
   d) Aliasing Effect.
   e) Discrete LTI System
   f) ROC and it's Properties