BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
BE, PART-III 6TH SEMESTER (IT) FINAL EXAMINATION, MAY 2012
Digital Signal Processing (IT – 604)

Full Marks = 70 **Time: 3 hrs.**

(Answer any FIVE questions)

1. (a) Find *z-Transform* with the ROC for each of the following sequences,
   (i) $x(n) = (\frac{1}{2})^n u(n) + (-\frac{1}{4})^n u(n); n > 0$
   (ii) $x(n) = \sin \omega_0 n$ for n>0
   (b) Define ROC of z-transform of a discrete sequence x(n).

   (4 + 7) + 3 = 14

2. (a) Find inverse z-Transform of the following:
   (i) $x(z) = \frac{z(1-e^{-T})}{(z-1)(z-e^{-T})}$
   (b) Check for linearity and time invariance,
   (i) $F[x(n)] = n[x(n)]^2$
   (ii) $Y(n) = \alpha + \sum_{k=-4}^{4} x(n-k)$

   4 + (5 + 5) = 14

3. (a) Find magnitude and phase response of $\delta(n) = -\pi$ and plot the curves.
   (b) Show that the following system is stable and LTI system. Plot the pole-zero diagrams for it.

$$H(z) = \frac{1+4z^{-1}}{1-\frac{1}{4}z^{-1}-\frac{3}{8}z^{-2}}$$

   (c) Explain all pole, stable and discrete time system.

   4 + 6 + 4 = 14

4. (a) Draw direct form II structure and transposed form II structure of the following system. Calculate hardware complexity of each design.

$$H(z) = \frac{0.44z^{-1} + 0.362z^{-2} + 0.02z^{-3}}{1 + 0.4z^{-1} + 0.18z^{-2} - 0.2z^{-3}}$$

(b) What are the properties of Linear phase FIR systems?
(c) Draw the linear phase FIR filter diagram for the following system
$H(z) = (1+1/2\ z^{-1} + z^{-2})(1+1/4z^{-1} + z^{-2})$

6 + 4 + 4 = 14

5. (a) Describe FIR filter design using rectangular window function. Show that the magnitude and phase response of the window function satisfies FIR filter properties.
(b) Describe the disadvantages of rectangular window technique and a method of rectification.
(c) What are the advantages of bilinear transformation over other IIR filter design techniques?

6 + 4 + 4 = 14

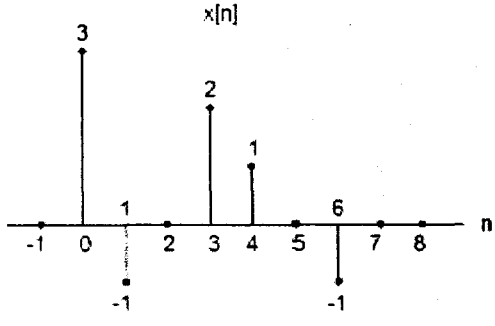
6. (a)Frequency response of a LP filter is,

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}; -3\pi/4 \le \omega \le 3\pi/4 \\ 0; 3\pi/4 < |\omega| \le \pi \end{cases}$$

Design FIR filter with M=7 using Hamming Window function.
(b) Explain the suffling of data and bit reversal in DITFFT.

8 + 6 = 14

7. (a) All parts use the signal x[n] shown below



Let X (e^{jw}) be the DFT of x[n]. R(k) if defined as follows,

$$R[k] = X(e^{j\omega})\big|_{\omega=\frac{2\pi k}{4}}, \quad 0 \le k \le 3$$

Find the signal r[n] which is the four-point inverse DFT of R[k].
(b) Find circular convolution of x(n) = {1,2,2,1} and h(n) = {2,1,1,2}.

8 + 6 = 14