Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, March 2015
(2008 Scheme)
Branch : Computer Science and Engineering
08.604 : DIGITAL SIGNAL PROCESSING (R)
(Special Supplementary)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Define and plot unit step and unit ramp signals.
2. What do you mean by time invariance ?
3. If $x(n) = nu(n) - (n-3)u(n-3) - (n-6)u(n-6) + (n-9)u(n-9)$, find
   a) $y_1(n) = x(3n-5) - x(2n)$
   b) $y_2(n) = x(-3n-2)$
4. Illustrate shifting operation by taking a unit step signal as an example.
5. What is the relation between Fourier Transform and Z-Transform ?
6. Define DFT. State and prove the shifting property of DFT.
7. Find the Z-Transform of a rectangular function.

$$x(n) = \begin{cases} A & \text{if } |n| \le N; \\ 0 & \text{if } |n| > N. \end{cases}$$

8. If X(z) is the Z-Transform of x[n], derive the Z-Transform of x[n – p].
9. Distinguish between IIR and FIR filters.
10. Explain the parallel form realization of IIR filters.

P.T.O.

PART – B

Answer **any one** question from **each** Module. **Each** question carries **20** marks.

Module – 1

11. a) Explain the concept of convolution. What is its significance in LTI systems ? **6**

    b) Find the convolution of the following pair of signals. Plot the input and output signals

    $x(n) = [1, 2, 3, 4]$ $h(n) = [1, 2, 1]$

    $s[n] = [1, 2, 2, 1]$ $r(n) = [-1, 2, -1, 3]$ **(7×2=14 Marks)**

12. a) Define linearity. What is its significance ? **4**

    b) Check whether the following systems are linear, time invariant, causal and/or causal i) $y(n) = nx[n]$ ii) $y[n] = 3x[n] + 1.5x[n-1]$. **(8×2=16 Marks)**

Module – 2

13. a) Draw the signal flow graph of an 8 point DIT FFT. **8**

    b) Consider a sequence x[n] defined for $0 \leq n \leq 7$, $x[n] = [1, 1, -1, 2, 2, -1, 2, 1]$. Evaluate 8 point-DFT of the sequence using FFT. **12**

14. a) Find X(k) and H(k) if $x[n] = [1, 2, 1, 2]$ and $h[n] = [2, 1, 2]$. Given that $Y(k) = X(k).H(k)$, find y[n]. **14**

    b) How is y[n] related to x[n] ? How can we make y[n] numerically equal to the linear convolution of x[n] and h[n] ? **6**

Module – 3

15. Realize the direct form – I and direct form – II structures of the IIR system represented by the transfer function $H(z) = \dfrac{2z^3 - 8z^2 + 11z - 2}{(z^2 - z + 0.5)(z - 1)}$.

16. Realize the following FIR systems with minimum number of multipliers.

    a) $H(z) = 0.5 + 0.3z^{-1} + 2z^{-1} + 3z^{-2} + 2z^{-1}$

    b) $H(z) = (1 + z^{-1} + 2z^{-1})(1 + 2z^{-1} + 3z^{-2})$