Reg. No. : [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Question Paper Code : 64039

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth/Sixth Semester

Electrical and Electronics Engineering

EC 65 — DIGITAL SIGNAL PROCESSING

(Common to Instrumentation and Control Engineering, Electronics and Instrumentation Engineering)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define BIBO stable.
2. State and prove the time reversal property of Z-transform.
3. What is the Z transform of $x(n) = \delta(n) - 0.95\ \delta(n-1)$?
4. State the convolution property of Z transform.
5. Draw the butterfly diagram for decimation in time FFT algorithm.
6. What is the relationship between DFT and Z transform ?
7. Define pre-warping effect. Why it is employed?
8. Give Hamming window function.
9. Define periodogram.
10. Define Gibbs phenomena.

PART B — ($5 \times 16 = 80$ marks)

11. (a) Determine the response of the following system to the input signal

$$x(n) = \begin{cases} |n|, -3 \le n \le 3 \\ 0, \ otherwise \end{cases}$$

(i) $x_1(n) = x(n-2)\,\delta(n-3)$

(ii) $x_2(n) = x(n+1)\,u(n-1)$

(iii) $y(n) = \frac{1}{3}[x(n+1) + x(n) + x\,(n-1)]$

(iv) $y(n) = \max\left[x\,(n+1), x(n), x(n-1)\right]$

(v) Find the even and odd components of given $x(n)$. (16)

Or

(b) A discrete time system can be

(i) Static or dynamic

(ii) Linear or non linear

(iii) Time invariant or time varying

(iv) Stable or unstable

Examine the following system with respect to the above mentioned properties $y(n) = x(n) + nx(n+1)$.

12. (a) (i) Find the Z-transform and ROC of $x(n) = r^2 \cos(n\theta) u(n)$. (8)

(ii) Find Inverse Z-Transform of $X(z) = z/[3z^2 - 4z + 1]$, ROC$|z| > 1$. (8)

Or

(b) (i) Determine the DTFT of the given sequence $x[n] = a^n (u(n) - u(n-8)), |a| < 1$. (8)

(ii) Prove the linearity and frequency shifting theorem of the Discrete Time Fourier Transform. (8)

13. (a) (i) The first five points of the eight point DFT of a real valued sequence are {0.25, 0.125 – j0.3018, 0, 0.125 – j0.0518, 0}. Determine the remaining three points. (4)

(ii) Compute the eight point DFT of the sequence $x = [1, 1, 1, 1, 1, 1, 1, 1]$, using Decimation-in-frequency FFT algorithm. (12)

Or

(b) Consider the sequences

$x_1(n) - \{0, 1, 2, 3, 4\}$, $x_2(n) = \{0, 1, 0, 0, 0\}$

$s(n) = \{1, 0, 0, 0, 0\}$

(i) Determine a sequence $y(n)$ so that $Y(k) = X_1(k) X_2(k)$. (8)

(ii) Is there a sequence $x_3(n)$ such that $S(k) = X_1(k) X_3(k)$? (8)

14. (a) Design an FIR linear phase, digital filter approximating the ideal frequency response $H_d(\omega) = \begin{cases} 1, & |\omega| \le \frac{\pi}{6} \\ 0, & \frac{\pi}{6} < |\omega| \le \pi \end{cases}$

Determine the coefficients of a 25 tap filter based on the window method with a rectangular window. (16)

Or

(b) (i) Convert the analog filter with system function $H_a(s) = \frac{s+0.1}{(s+0.1)^2+9}$ into a digital IIR filler by means of the impulse invariance method. (8)

(ii) Draw the direct form I and direct form II structures for the given difference equation
$y(n) = y(n-1) - 0.5\ y(n-2) + x(n) - x(n-1) + x(n+2)$. (8)

15. (a) Explain various addressing modes of a digital signal processor. (16)

Or

(b) Draw the functional block diagram of a digital signal processor and explain. (16)
