Code : 041710

B.Tech 7th Semester Exam., 2017

DIGITAL SIGNAL PROCESSING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer/Answer the following questions (any *seven*) : 2×7=14

(a) The signal $x(n) = \cos 2nu(n)$ is

(i) periodic and causal

(ii) periodic but not causal

(iii) aperiodic and causal

(iv) aperiodic and non-causal

(b) What is random signal?

(c) Define symmetric signal and anti-symmetric signal.

(d) Poles of Butterworth filter lie on

(i) ellipse

(ii) circle

(iii) parabola

(iv) None of the above

(e) Give any two properties of Butterworth low-pass filters.

(f) The z-transform of the sequence $x(n) = a^n u(n)$ is

(i) $\frac{1}{1-az}$

(ii) $\frac{1}{1-az^{-1}}$

(iii) $\frac{-z}{z-a}$

(iv) $\frac{1}{z-a}$

(g) ROC of a causal signal is the exterior of a circle of some radius r. (True/False)

(h) What is the reason that FIR filter is always stable?

(i) State BIBO stability criterion.

(j) Define signal.

2. *(a)* Draw the block diagram of a digital signal processing system and explain about each block. 7

(b) Distinguish between analog and digital systems. Explain with examples. 7

3. *(a)* Define convolution sum and discuss the properties of convolution sum. 7

(b) Find the cross-correlation of two finite length sequences using graphical method

$x(n) = [1, 2, 1, 1]$ and $y(n) = [1, 1, 2, 1]$ 7

4. *(a)* Find the impulse response of the discrete time system described by the difference equation

$$y(n-2) - 3y(n-1) + 2y(n) = x(n-1)$$ 7

(b) $y(n) + 5y(n-1) + 6y(n-2) = x(n-1) + 2x(n)$ where $x(n) = u(n)$. The initial conditions are $y(-1) = 1$ and $y(-2) = 0$. Find *(i)* zero input response and *(ii)* zero state response. 7

5. *(a)* Define z-transform pair and mention the properties of ROC. 7

(b) Find the DTFT of

$$x(n) = \left(\frac{1}{2}\right)^n u(n)$$

and plot the spectrum (amplitude spectrum and phase spectrum). 7

6. *(a)* State sampling theorem and explain aliasing effect. 7

(b) Find the DFT of a sequence $x(n) = [1, 2, 3, 4, 4, 3, 2, 1]$ using DIT-FFT algorithm. 7

7. *(a)* Distinguish between DFT and DTFT, and find the DFT of a sequence

$x(n) = [1, 1, 0, 0]$ 7

(b) What is FFT? How can we calculate IDFT using FFT algorithm? 7

8. *(a)* Distinguish between the frequency response of Chebyshev type–I and type–II filters. 7

(b) What are the different types of structures for realization of IIR system? Determine the direct form II realization for the following system :

$$y(n) = -0 \cdot 1y(n-1) + 0 \cdot 72\, y(n-2) + 0 \cdot 7x(n) - 0 \cdot 252\, x(n-2)$$

9. Write short notes on the following : 7+7=14

(a) FIR filters

(b) Correlation of discrete time signal

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