

PDFZilla – Unregistered

PDFZilla - Unregistered

PDFZilla - Unregistered

Total No. of printed pages = 6

EC 131505

Roll No. of candidate

--	--	--	--	--	--	--	--	--	--

2017

B.Tech. 5th Semester End-Term Examination

Electronics and Communication

DIGITAL SIGNAL PROCESSING

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer Question No. 1 and any *Six* from the rest.

1. (a) Fill in the blanks with appropriate words:
(5 × 1 = 5)
- (i) In a discrete time signal $x(n)$, if $x(n) = x(-n)$ then it is called _____ signal.
 - (ii) A discrete time system is _____ if it obeys the principle of superposition.
 - (iii) The response of an LTI system is given by _____ of input and impulse response.
 - (iv) If $x(n)$ is finite duration right sided signal, then the ROC is _____.
 - (v) The convolution of N_1 sample and N_2 sample sequence produce a sequence consisting of _____ samples.

[Turn over

(b) Choose the right answer. $(5 \times 1 = 5)$

- (i) For energy signals, the energy will be finite and the average power will be
- (1) infinite
 - (2) finite
 - (3) zero
 - (4) cannot be defined.
- (ii) The system described by the input-output equation $y(n) = nx(n) + bx^3(n)$ is a
- (1) static system
 - (2) dynamic system
 - (3) identical system
 - (4) none of the above
- (iii) Which of the following signal is the example for deterministic signal?
- (1) ramp
 - (2) step
 - (3) exponential
 - (4) all of the above
- (iv) If Z-transform of $x(n)$ is $X(z)$ then Z-transform of $x(-n)$ is,
- (1) $-X(z)$
 - (2) $X(-z)$
 - (3) $-X(z^{-1})$
 - (4) $X(z^{-1})$

(v) The initial value $x(0)$ of $X(z) = \frac{1}{1-z^{-2}}$ is

- (1) 0
 - (2) 1
 - (3) 0.5
 - (4) none of the above
2. (a) What is digital signal processing? Write a few advantages and disadvantages of digital signal processing. $(2+6=8)$
- (b) State some applications of digital signal processing. (7)
3. (a) Define IIR and FIR systems. Give example. (3)
- (b) Determine the values of power and energy of the following signal; (6)
- $$x(n) = \left(\frac{1}{3}\right)^n u(n).$$
- (c) Check whether the system is causal or not. (3)
- $$y(n) = x(2n)$$
- (d) Check the stability of the LTI system whose impulse response is $h(n) = 0.2^n u(n)$. (3)
4. (a) Draw the block diagram and signal flow graph of the following difference equation: (6)
- $$y(n) = 7y(n-1) - 3x(n) + 8x(n-2).$$
- (b) State and prove the time shifting property of z -transform. (5)
- (c) Find the Z-transform of the following: (4)
- $$x(n) = a^n u(n).$$

5. (a) Determine the impulse response $h(n)$ for the system described by the second order difference equation. (7)

$$y(n) + 4y(n-1) + 3y(n-2) = x(n-1).$$

(b) $H(z) = \frac{z+0.5}{(z-0.5)(z^2+1.414z+1)}$. (8)

Sketch the z plane pole zero plot and determine the stability status for the system.

6. (a) Find the inverse Z-transform of (7)

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

(i) If ROC is $|z| > 1$

(ii) If ROC is $|z| < \frac{1}{3}$

(iii) If ROC is $\frac{1}{3} < |z| < 1$

- (b) Perform circular convolution of the following sequences. (8)

$$x_1(n) = \{1, -1, -2, 3, -1\} \text{ and } x_2(n) = \{1, 2, 3\}.$$

7. (a) Determine the Direct form-I and Direct form-II realizations of the 3rd order IIR transfer function. (6)

$$H(z) = \frac{0.28z^2 + 0.319z + 0.04}{0.5z^3 + 0.3z^2 + 0.17z - 0.2}.$$

- (b) Determine the cascade realization of the following system function: (5)

$$H(z) = \frac{2(z+2)}{z(z-0.1)(z+0.5)(z+0.4)}$$

- (c) Compute the 4-point DFT of the sequence, (4)

$$x(n) = \begin{cases} \frac{1}{3}; & 0 \leq n \leq 2 \\ 0; & \text{else} \end{cases}.$$

8. (a) What is twiddle factor? Mention and prove its properties. (5)

- (b) Find the 8-point DFT of the following sequence using DIT-FFT algorithm. (10)

$$x(n) = \{1, -1, -1, -1, 1, 1, 1, -1\}$$

9. (a) Convert the analog filter with system function $H(s) = \frac{s+a}{(s+a)^2 + b^2}$ into a digital IIR filter by means of the impulse invariant method. (6)

- (b) An analog filter has the following transfer function $H(s) = \frac{1}{s+1}$. Using bilinear transformation technique, determine the transfer function of the digital filter. (4)

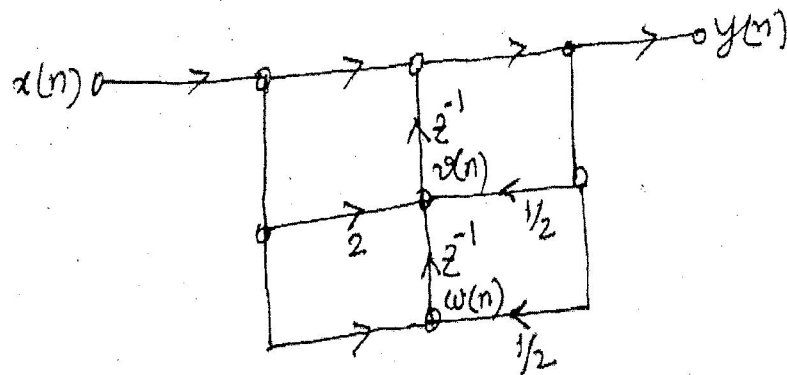
- (c) Discuss briefly the conditions necessary for a realizable digital filter to have a linear phase characteristics and the advantage of filters with such a characteristic. (5)

10. (a) Consider the complex sequence

$$x(n) = \begin{cases} e^{j\omega_0 n}, & 0 \leq n \leq N-1 \\ 0, & \text{otherwise} \end{cases}$$

Find the N-point DFT of the finite length sequence $x(n)$.

- (b) Consider the signal flow graph in the figure below.



- Using the node variable indicated write the set of difference equations represented by this network.
- Draw the flow graph of an equivalent system that is the cascade of two first-order systems.
- Is the system stable? Explain.