BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BE | **SEMESTER: IV/ADD**
BRANCH: EEE | **SESSION : SP/2019**

SUBJECT : EE4207-DIGITAL SIGNAL PROCESSING

TIME: 1.5 HOURS | **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

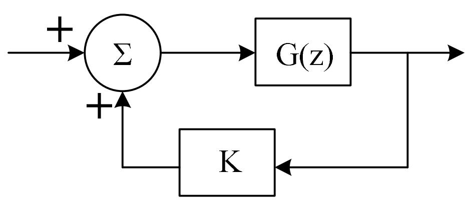
Q1 (a) Suppose x(n) = {3, 4, $\underline{5}$, 6}[zero position at 3rd sample]. (i) Find g(n) = x (2n -1) and the step-interpolated signal h(n) = x (0.5n – 1). (ii) Find y(n) = x (2n / 3) assuming step interpolation where needed. [2]

(b) The following systems have input x(n) and output y(n). For each system, determine whether it is memoryless, stable, causal, linear, or time-invariant. (i) y(n) = median {x(n-1), x(n), x(n+1)} (ii) y(n) = sgn [x(n)] (iii) y(n) = $x(n^2)$. [3]

Q2 (a) These are the following five facts about a particular LTI system with impulse response h(n) and z-transform H(z): (i) h[n] is real. (ii) h[n] is right-sided. (iii)$\lim_{z\to\infty} H(z) = 1$. (iv) H(z) has two zeros. (iv) H(z) has one of its poles at a non-real location on the circle defined by $|z|$ = (3/4). Based on five facts (a) Is this system causal? (b) Is this system stable? [2]

(b) An LTI system is characterized by the system function $H(z) = (3- 4z^{-1}) / (1- 3.5z^{-1} + 1.5z^{-2})$. Specify the ROC of H(z) and determine h[n] for the following conditions:(i) The system is causal and unstable. (ii) The system is noncausal and stable. (iii) The system is anti-causal and unstable. [3]

Q3 (a) Consider the discrete-time system shown in the figure 1. Where the impulse response of *G*(*z*) is *g*(0) = 0, *g*(1) = *g*(2) = 1, *g*(3) = *g*(4) = …… = 0. Find the range of values of *K* for stable system [2]



(b) Consider a sequence $x[n] = 2^{-n} u[n]$, with its DTFT given by $X(e^{jw})$. Let y[n] be a finite-duration signal of length10. Suppose the 10-point DFT, Y(k), of y[n] is given by10 equally spaced samples of $X(e^{jw})$. Determine y[n]. [3]

Q4 (a) Perform the circular convolution of the following two sequences $x_1(n) = \{\underline{1}, 2, 3\}$ and $x_2(n) = \{\underline{1}, 2, 3, 4\}$ [By any method] [2]

(b) X(k) be a 14-point DFT of a length-14 real sequence x(n). The first eight samples are given by X(0) = 12, X(1) = -1+ j3, X(2) = 3+ j4, X(3) = 1- j5, X(4) = -2+ j2, X(5) = 6+ j3, X(6) = -2- j3, X(7) = 10. Determine the remaining samples of X(k). Evaluate the following function of x(n), without computing IDFT of X(k). (i) x (7) (ii) $\sum_{n=0}^{13} \exp(j4\pi n/7)\, x(n)$. [3]

PTO

Q5 (a) Describe the relationship between z-transform and Discrete -Time Fourier series. [2]

(b) Consider the 4-point DFT of the sequence x(n) = {<u>-2</u>, 2, 1, -1} using DIF-FFT algorithm [3]

Q6 (a) Find the linear convolution of the two sequences $x(n) = \{0$ for $n < -5$ and $(1/2)^n$ for $n \geq -5\}$ and $h(n) = \{0$ for $n < 3$ and $(1/3)^n$ for $n \geq 3\}$. [2]

(b) Obtain (i) direct-form I and (ii) direct form II(canonical) realizations of the system function r $H(z) = [1+ 2z^{-1} - z^{-2}] / [1+ z^{-1} - z^{-2}]$ [3]

:::: 02/03//2019 E::::::