Roll No. _____

Indian Institute of Information Technology Ranchi

Department of Electronics & Communication Engineering
B. Tech Mid Semester Examination – Spring Semester 2022-23

Semester: Sixth **Course Instructor: Dr. Rashmi Panda**

Course Code: EC-3006 **Course Name: Digital Signal Processing**

QUESTION PAPER

Duration: 2 hrs. **Max Marks: 60**

Instructions:
(1). Number in [ ] indicates marks.
(2). Any missing data can be assumed suitably.
(3). Symbols have their usual meaning.

Answer All Questions

Section A

1. (a) What is/are the condition for a system to be linear? [2]

(b) The impulse response $h(n)$ of an LTI system is given by $h(n) = u(n+4) + u(n-2) - 2u(n-8)$. where $u(n)$ is the step sequence. Comment on the stability and causality of the system. [2]

(c) What is twiddle factor? State the symmetry and periodicity property of twiddle factor with example. [2]

(d) Two discrete time system with impulse response $h_1(n) = \delta(n-2)$ and $h_2(n) = \delta(n-3)$ are connected in cascade. What is the overall impulse response of the cascaded system? [2]

(e) What is the computational complexity of 1024 point DFT? [2]

(f) Compare linear convolution with circular convolution of two sequences. [2]

(g) Find the 4-point DFT of the sequence $x(n) = \{\underset{\uparrow}{1}, 0, -1, 0\}$ [2]

(h) What is meant by region of convergence (ROC) of Z transform? Explain its significance in stability of a system. [2]

(i) Establish the relationship between Fourier transform and Z transform. [2]

(j) For the given sequence $x(n) = \{\underset{\uparrow}{1}, 0, -1, 0\}$. Find out (i) $x(n-2)$ and (ii) $x((-n-2))_4$ [2]

Section B

2. (a) Find out the Z transform and ROC of the following sequences [10]

(i) $x(n) = -n\, a^n u(-n-1)$

(ii) $x(n) = (0.4)^n u(n) + (0.3)^n u(n-4)$

(b) Find out the inverse Z transform of $X(z) = \dfrac{z(z^2 - 4z + 5)}{(z-3)(z-1)(z-2)}$ using any one method of your choice for ROC (i) $2 < |z| < 3$ (ii) $|z| > 3$ (iii) $|z| < 1$ [10]

3. (a) Perform linear convolution of finite duration sequences $h(n) = \{1, 1, 2\}$ and $x(n) = \{1, -1, 1, 2, 1, 0, 1, -4, 3, 2, 1\}$ by using overlap-save method (Use N=5). [10]

(b) Check whether the given systems are linear, time variant [10]

(i) $y(n) = x(4n+1)$

(ii) $y(n) = x(n)u(n)$

(iii) $y(n) = x(n) + n\,x(n+1)$

(iv) $y(n) = \log_{10} x(n)$

(v) $y(n) = x^2(n)$

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