Code No: 127CK

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, July/August - 2022
DIGITAL SIGNAL PROCESSING
(Electrical and Electronics Engineering)

Time: 3 Hours **Max.Marks:75**

Answer any five questions
All questions carry equal marks
- - -

1.a) For the impulse $h(n) = \delta(n) + \sin \pi n$, determine whether the corresponding system is i) causal ii) stable.
b) Find the response of the difference equation $y(n) + y(n-1) = x(n)$ where $x(n) = \cos 2n$. [6+9]

2.a) Determine the system function $H(z)$, impulse response $h(n)$ of the LTI system defined by the difference equation.
$y(n) = x(n) + 3x(n-1) + 2y(n-1) - y(n-2)$
b) Realize the FIR system $H(z) = 1 + 2z^{-1} + \frac{1}{2}z^{-2} - \frac{1}{2}z^{-3} - \frac{1}{2}z^{-4}$ in Cascade form and Lattice structure. [7+8]

3.a) Compute the DFT of the square wave sequence.

$$x(n) = \begin{cases} 1 & 0 \le n \le \frac{N}{2} - 1 \\ -1 & \frac{N}{2} \le n \le N-1, \quad Where\ N\ is\ even \end{cases}$$

b) State and prove the properties of Discrete Fourier series. [7+8]

4.a) Draw the signal flow graph for 8-point DFT using DIT algorithm.
b) Compute IDFT of the sequence
$X(k) = \{16, 1 - j4.4120, 0, 1 + j0.4142, 0, 1 - j0.4142, 1 + j4.4142\}$ using DIF algorithm. [6+9]

5.a) Design a Chebyshev lowpass filter with the specifications $\alpha_p = 1dB$ ripple in the pass band $0 \le \omega \le 0.2\pi$, $\alpha_s = 15dB$ ripple in the stop band $0.3\pi \le \omega \le \pi$ using Impulse Invariance.
b) Distinguish between Butterworth and Chebyshev filters. [10+5]

6.a) Design a band stop Butterworth filter with stop band 100 to 600Hz, 20dB attenuation at 200 and 400 Hz, gain is unity at $\omega = 0$ and passband attenuation is 3dB.
b) Discuss in detail about Spectral transformations. [10+5]

7.a) Design a Bandpass filter using Fourier series method with N=7.

$$H(e^{j\omega}) = \begin{cases} 1 & for\ \frac{\pi}{6} \le |\omega| \le \frac{\pi}{3} \\ 0 & otherwise \end{cases}$$

b) Use the window method with a Hamming window to design a 12-tap differentiator with N=12. [8+7]

8.a) Derive an expression for the spectrum of output signal of a decimator.
b) Explain the methods to prevent Overflow in detail. [8+7]

---oo0oo---