

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May 2025
B. Tech. (ECE), Semester VI, 2024-25

Roll No.....

EE1115: Digital Signal Processing

Time: 2.30 hours

Max. Marks: 30

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Mention all the assumptions for your answers clearly.
3. Use of calculator is allowed.

- Q. 1 a) Draw and explain the block diagram of real time DSP system. 6.0
b) Explain in detail Gibbs Phenomenon for designing of FIR filter. (LO 1,2)
c) Describe any 4 applications of DSP in various fields.

- Q. 2 The first-order difference equation $y[n] - a y[n-1] = x[n]$, $0 < a < 1$, describes a particular discrete-time system initially at rest. 5.0
a) Verify that the impulse response $h[n]$ for this system is $h[n] = a^n u[n]$. (LO 1,2)
b) Is the system
(i) memoryless? (ii) causal? (iii) stable? Clearly state your reasoning.
c) Is this system stable if $|a| > 1$?

- Q. 3 Obtain the cascade form realization structure for the following system function. 4.0
(LO 5,6)

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

Obtain the parallel form realization structure for the following IIR system function.

$$H(z) = \frac{3z(5z-2)}{(z+0.5)(3z-1)}$$

- Q. 4 Design a IIR digital low pass Butterworth Filter using impulse invariant method that satisfies the following specifications. 5.0
(LO 5, 6)

Pass band $0.8 \leq |H(e^{j\omega})| \leq 1$ $|\omega| \leq 0.2\pi$

Stop band $|H(e^{j\omega})| \leq 0.2$ $0.6\pi < |\omega| < \pi$

Assume $T=1s$.

- Q. 5 Design a Chebyshev analog Filter with a maximum pass band attenuation of 2.5 dB at $\Omega_p = 20$ rad/sec and a minimum stop band attenuation of 30 dB at $\Omega_s = 50$ rad/sec. 5.0
(LO 5,6)

- Q. 6 The desired frequency response of high pass filter is given by 5.0
(LO 5, 6)

$$H_d(e^{j\omega}) = \begin{cases} e^{-j\tau\omega} & \omega_c \leq |\omega| \leq \pi \\ 0 & |\omega| < \omega_c \end{cases}$$

Design a linear phase FIR filter using Hamming window for $M=7$ and $\omega_c = 2$ rad/sample.