PokharaEngineering College
Internal assessment- 2025

Year: 2025
Full Marks: 100
Time: 3 hrs.

Level: Bachelor
Programme: BE
Course: Digital Signal Analysis and Processing

Candidates are required to give their answer in their own words as far as practicable.
Figures in the margin indicate full marks.
Attempt all the questions.

1. a) Define signal processing? Compare between energy signal and power signal. 8

b) Explain the basic elements of a digital signal processing system. 7

2. a) A first order IIR system defined by the difference equation 7

$$y[n] - cy[n-1] = x[n]$$

Find:
i. System function
ii. Condition for stability
iii. Impulse response

b) Plot the magnitude and phase response of the system which has pole pair at $r = 0.9$ and $\theta = \frac{\pi}{4}$. 8

3. a) Determine the causal signal x(n) having the Z-transform 7

$$X(Z) = 1/[(1-2z^{-1})(1-z^{-1})]$$

b) Define ROC. Explain the properties of ROC. 8

4. a) Design a lowpass filter to be used in an ADC-H(z)-DAC structure that will have a $-3\ dB$ cutoff of $30\pi\ rad/sec$ and an attenuation of 40 dB at $45\pi\ rad/sec$. The filter is required to have a linear phase. Use a sampling rate of 100 $samples/sec$. 7

b) Design an FIR linear phase FIR filter using Kaiser window to meet the following specifications.

$$0.99 \le |H(e^{j\omega})| \le 1.01, \quad 0 \le |\omega| \le 0.4\pi$$
$$0 \le |H(e^{j\omega})| \le 0.001, \quad 0.6\pi \le |\omega| \le \pi$$

3+5

5. a) Obtain the cascade structure of the system with difference equation 7

$$y[n] = 3/4\ y[n-1] - 1/8\ y[n-2] + x[n] + 1/3\ x[n-1]$$

b) Given a three-stage lattice filter with coefficients $K_1 = \frac{1}{4}$, $K_2 = \frac{1}{4}$, $K_3 = 1/3$, determine the FIR filter coefficients for the direct-form structure. 8

6. a) Design a low pass discrete- time filter by applying impulse invariance to an approximate Butterworth continuous filter, if passband frequency is 0.5π radians and maximum deviation of 1dB below 0 dB gain in the passband. The maximum gain of -40 dB and frequency is 0.7π radians in the stopband. 8

b) Discuss the FIR filter design by BLT method. 7

7. Write short notes on the following **(any two):** 2×5
   a) Convolution sum
   b) Elementary discrete-time signals
   c) Gibb's phenomenon