

Con. 5881-07.

(REVISED COURSE)

CD-5628

(3 Hours)

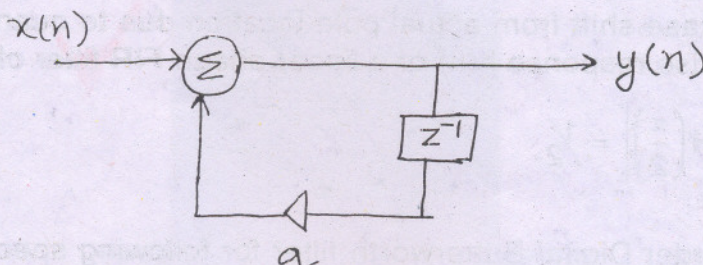
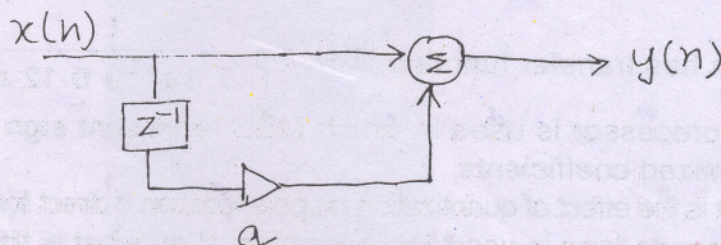
[Total Marks : 100

N.B. : (1) Question No. 1 is compulsory.

(2) Attempt any four questions out of remaining six questions.

(3) Assume suitable data if required.

1. (a) Compare IIR and FIR filter. 4
- (b) Find z-transform of periodic sequence $x(n) = \{-1, 4, -2, 3\}$. 4
- (c) A digital filter has three zeroes which are located at $Z_{1,2} = 0.5 e^{\pm j \frac{\pi}{4}}$, $Z_3 = 1$. Three poles are at origin. Is it a FIR filter? Is it a linear phase filter? Justify. 4
- (d) Obtain the impulse response of the systems shown below and comment on their stability when $a = 1/2$ and $a = 2$ 8



2. (a) An analog signal is sampled 600 times/ second $x_a(t) = \sin(480\pi t) + 3\sin(720\pi t)$.
- (i) Determine Nyquist rate for $x_a(t)$. 2
- (ii) Determine the folding frequency. 2
- (iii) What are the frequencies in radian in the resulting Discrete time signal? 2
- (iv) If $x(n)$ is passed through an ideal D/A converter, What is the reconstructed signal $y_a(t)$? 2
- (v) Obtain linear convolution of two sequences. 10
- $x(n) = u(n) - u(n-3)$
 $h(n) = u(n-1) + u(n-2) - u(n-4) - u(n-5)$ using circular convolution.
3. (a) Let $x(n]$ be a 8 point sequence. Its corresponding DFT $X(k)$ is
 $X(k) = \{0.5, 2 + j, 3 + 2j, j, 3, -j, 3 - 2j, 2 - j\}$
 Find $x(n]$ by performing IFFT (Inverse FFT). 10
- (b) A digital filter has frequency specifications as follows 10
- passband frequency, $\omega_p = 0.2\pi$
 stopband frequency, $\omega_s = 0.3\pi$.
- What are corresponding specifications for passband and stopband frequency in analog domain if,
- (i) Impulse invariance technique is used for designing
- (ii) Bilinear Transformation is used for designing.

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4. When input to LTI system is $x(n) = \left(\frac{1}{2}\right)^n u(n) + 2^n u(-n-1)$

the output is $y(n) = 6\left(\frac{1}{2}\right)^n u(n) - 6\left(\frac{3}{4}\right)^n u(n)$

- (a) Find system function $H(z)$ of the system. 4
- (b) Show DF-I, DF-II realization of the system. 4
- (c) Obtain the impulse response of the system. 6
- (d) Obtain the expressions for Magnitude response and phase response and sketch it. 2
- (e) Identify the system type based on its passband and its phase response.

5. (a) DT system has transfer function $H(z) = \frac{1}{1-0.8z^{-1} + 0.12z^{-2}}$

A four bit processor is used in which MSB represent sign bit and remaining 3 bit store quantized coefficients. 4

- (i) What is the effect of quantization on pole location if direct form II is used for realization. 4
 - (ii) If cascade form is used for realization, then what is the change in pole values after quantization. 2
 - (iii) In which case shift from actual pole location due to quantization is less. 10
- (b) Determine impulse response $h(n)$ of a linear phase FIR filter of length 4 for which

$$|H(0)| = 1 \text{ and } \left|H\left(\frac{\pi}{2}\right)\right| = \frac{1}{2}.$$

6. (a) Design a 2nd order Digital Butterworth filter for following specifications. 10

- Attenuation in passband = 3dB
- Passband frequency = 0.8π
- Attenuation in stopband = 10 dB
- Stopband frequency = 0.6π

(b) Design low pass filter if desired frequency response is :

$$H_d(e^{jw}) = e^{-j2w} \text{ for } -\frac{\pi}{3} \leq w \leq \frac{\pi}{3}$$

$$= 0 \text{ for } \frac{\pi}{3} < |w| \leq \pi$$

Use Rectangular window.

- 7. (a) With the help of neat block diagram, explain any one DSP processor in detail. 6
- (b) Derive the relationship of DFT to Fourier Transform and Z-Transform. 4
- (c) Test the linearity and time invariance of the following system :
 - (i) $y(n) = \text{trunc}[x(n)]$
i.e. $y(n) = \text{truncation of } x(n)$
 - (ii) $y(n) = n x(n) + x(n-1)$.