Department of Electronics Communication

Question Bank for III B.Tech Sem-II ECE (2018-19)

Subject: **Digital Signal Processing (R16)**

Unit-1

1(a)Determine the zero-input response and impulse response h[n] of the system described by the second-order difference equation:

$y(n) - 3y(n-1) - 4\,y(n-2) = x(n) + 2x(n-1)$

(b) Derive the relationship between impulse response and frequency response of a discrete time system.

2 (a) Explain causality and stability of a linear time invariant system.

(b) Determine the frequency response, magnitude and phase responses and time delay of the systems given by

y(n)-0.5y(n-1)=x(n)

3(a) Determine the frequency response, magnitude and phase responses and time delay of the systems given by

y(n)=x(n)-x(n-1)+x(n+2)

(b) State and explain the transfer function of an LTI system.

4 (a)Determine frequency, magnitude and phase responses and time delay for the system.

y(n)+0.25y(n-1)=x(n)-x(n-1)

(b) Define the terms : linearity, time invariance and causality for a discrete time system.

5(a) Define various elementary discrete time signals. Write notes on them and explain about their properties.

(b) Determine whether the following systems are time invariant or not

a)y[n]=x[n]+nx[n-3] b)y[n]=sin(x[n]).

Unit-2

1(a) Compute the FFT for the sequence x(n) = n+1 where N =8 using DIT algorithm

(b) State and prove the periodicity property in DFT.

2(a) Find the N-point DFT for x(n) = an for 0 < a < 1? [

(b) Given x(n) = {1,2,3,4,4,3,2,1}, find X(k) using DIF FFT algorithm.Define DFT of a sequence x(n). Obtain the relationship between DFT and DTFT.

3(a) Find the DFT of the following sequence using FFT DIF?
X(n) = {1,2,3,5,5,3,2,1}
(b) Compute the DFTs of the sequence x(n) = 2^{-n}, where N = 8 using DIT
4(a) Compute the DFT of the sequence x(n) = sin[nπ/4], where N=8 using DIT FFT algorithm
b) Determine the IDFT of the sequence
X(K)=(6,-√2j4.8284,-2+j2, ,√2-j4.8284,-2, ,√2+j4.8284,-2-j2, ,-√2-j4.8284)
5 Explain the inverse FFT algorithm to compute inverse DFT of N=8 Sequence. Draw the Flow Graph.

Unit-3

1. Obtain the cascade and parallel realisation structures for the following signals.

2. Determine the impulse response of the system described by the difference equation

   y[n] = 0.6 y[n-1] - 0.08 y[n-2] + x[n] using Z transform.

3. Obtain the Direct Form I and Direct Form II realization for the system described by

$$H(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}}$$

4. Explain the different structures for realization of IIR system and explain how conversion can be made from direct form I structure to direct form II structure.

5. a) Compute lattice structures with direct form structures.

   b) Draw the lattice form implementation for FIR filter having transfer function

$$H(z) = (1 + 2z^{-1})(3 + 4z^{-1})(5 + 6z^{-1})$$

6. Test for the stability of the following system:

$$y(n) = \frac{3}{8}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}[n-1]$$

   Is it an IIR system or an FIR system? Explain the reason. Also realize the system using cascade structure.

$$H = \frac{1 + \frac{1}{2}z^{-1}}{\left(1 - z^{-1} + \frac{1}{4}z^{-2}\right)\left(1 - z^{-1} + \frac{1}{2}z^{-2}\right)}$$

Unit-4

1. Design a digital low pass filter with pass band cut off frequency ω_p=0.375π with δ_p=0.01 and stop band frequency ω_s=0.5π with δ_s=0.01.The filter is to be designed with bilinear transformation method.
2. Design a high pass filter using hamming window with a cut-off frequency of 1.2 rad/sec and N=9.
3. Find filter order for following specifications:

$$0.5 \le H(e^{j\omega}) \le 1 \; for \; 0 \le \omega \le \frac{\pi}{2}$$

$$H(e^{j\omega}) \le 0.2 \; for \; \frac{3\pi}{4} \le \omega \le \pi$$

With T = 1 sec. Use Impulse Invariant method.

4. Design a FIR low pass filter with a cut-off frequency of 1 kHz and sampling rate of 4 kHz with eleven samples using Fourier series method.
5. Determine the order and transfer function of the Chebyshev filter for following specifications:

i. Maximum pass band ripple is 1dB for Ω ≤ 4 radians/sec.

ii. Stop band attenuation is 40 dB for Ω ≥ 4 radians/sec.

6. Design a low pass digital FIR filter using Kaiser Window satisfying the specifications given below. Pass band cut-off frequency = 150 Hz.

Stop band cut-off frequency = 250 Hz.

Pass band ripple = 0.1dB

Stop band attenuation = 40 dB

Sampling frequency = 1000 Hz

Unit-5

1(a) Derive an expression for the spectrum of output signal of an decimator.

(b) What are the applications of multirate system?

2. (a) Discuss the applications of Multirate Digital Signal Processing.

b) Draw the block diagram of a multistage interpolator and explain it

3. (a) Draw the block diagram of a multistage decimator and explain it

(b) Discuss the computationally efficient implementation of decimator in an FIR filter.

4.(a) How can sampling rate be converted by a rational factor M/L? [8M]

(b) Draw and explain the polyphase structure of a interpolator.

5. For a given discrete sequence $x[n]$ = {1, 2,3, 4,5,6,7,8,9}, determine and sketch the up sampling sequence $y[n] = x[2n]$.

Unit-6

1(a) Explain the purpose of six registers used in the TMS320C2X processor

(b) What are the limitations of pipelining in Digital Signal Processor?

2. (a) Draw and explain the major block diagram of the TMS320C3X.

   (b) Explain the function of Barrel Shifter in the digital signal processor..

3. (a) Draw and explain the memory architecture of the TMS320C3X processor.

   (b) What are the major advantages of having on-chip memory?

4. (a) What is MAC? Explain its operation in detail.

   (b) What are the various addressing modes used in the TMS320C5X processor?

5. a) Draw and explain the bus architecture of DSP processors.

   b) Briefly explain the special addressing modes available in DSP processors.