SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRONICS AND INSTRUMENTATION ENGINEERING

QUESTION BANK

V SEMESTER

EC3568- DISCRETE TIME SIGNAL PROCESSING

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Prepared by

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DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEEING

QUESTION BANK

SUBJECT: 1907502- DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING

SEM / YEAR: V / III

UNIT-I CLASSIFICATION AND ANALYSIS OF SIGNALS				
Classification of systems: Continuous , discrete, linear, causal, stable, dynamic, recursive, time variance- Classification of signals: continuous and discrete, energy and power, Deterministic and Random, Periodic and Aperiodic; Mathematical representation of signals-Spectral density - Sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect-Digital signal representation.				
PART –A				
Q.No	**Questions**	**CO level**	**BT Level**	**Competence**
1.	What are the classifications of discrete time systems?	**CO1**	**BTL1**	Remember
2.	Determine if the system is linear or not. $y(n) = x^2(n)$.	**CO1**	**BTL2**	Understand
3.	Define linear system.	**CO1**	**BTL1**	Remember
4.	What is casual system?	**CO1**	**BTL1**	Remember
5.	If $y[n] = x[n^2]$, is the system causal?	**CO1**	**BTL2**	Understand
6.	If $y(n) = x(n+1) + x(n+2)$, is the system causal?	**CO1**	**BTL2**	Understand
7.	Test if the system is stable or not. $y(n) = x(n)u(n)$.	**CO1**	**BTL2**	Understand
8.	Check if the system $y(n) = x(n)x(n-1)$ is static.	**CO1**	**BTL2**	Understand
9.	Write the property of recursive and non-recursive systems.	**CO1**	**BTL1**	Remember
10.	What is time invariant system?	**CO1**	**BTL1**	Remember
11.	Find if the system is time invariant (or) not. $y(n) = x(-n)$.	**CO1**	**BTL2**	Understand
12.	What is an LTI system?	**CO1**	**BTL1**	Remember
13.	What is causality condition for LTI system?	**CO1**	**BTL1**	Remember
14.	Differentiate between Energy and Power signals.	**CO1**	**BTL2**	Understand
15.	What is a Deterministic signal?	**CO1**	**BTL1**	Remember
16.	Define periodic and non-periodic signal.	**CO1**	**BTL1**	Remember
17.	What is meant by spectral density?	**CO1**	**BTL1**	Remember
18.	State sampling theorem.	**CO1**	**BTL1**	Remember
19.	What is meant by sampling?	**CO1**	**BTL1**	Remember
20.	Define Quantization error.	**CO1**	**BTL1**	Remember
21.	List the sampling techniques.	**CO1**	**BTL1**	Remember

22.	State Nyquist rate.	**CO1**	**BTL1**	Remember
23.	Calculate the Nyquist rate for the following signal: $x(t) = 1 + 2cos1000\pi t - \sin 500\pi t.$	**CO1**	**BTL2**	Understand
24.	What is meant by digital signal representation	**CO1**	**BTL2**	Understand
	PART – B			
1.	Test if the following systems are linear or not. **(8+8)** **(i)** $y(n) = ax(n) + bx(n-1)$ **(ii)** $y(n) = cosx(n)$	**CO1**	**BTL5**	Evaluate
2.	Test if the following systems are casual or not. **(8+8)** **(i)** $y(n) = x(n) + x^2(n-1)$ **(ii)** $y(n) = x(n+1) + 3x(n) + 5x(n-1)$	**CO1**	**BTL5**	Evaluate
3.	Determine the stability for each of the following linear systems: **(16)** **(i)** $y(n) = x(2n)$ **(ii)** $y(n) = x(-n)$ **(iii)** $y(n) = e^{x(n)}$	**CO1**	**BTL3**	Apply
4.	Find whether the following systems are static (or) dynamic. **(4+4+4+4)** **(i)** $y(n) = x^2(n) + x(n-1)$ **(ii)** $y(n) = x(2n)$ **(iii)**$y(n) = 2x^2(n)$ **(iv)** $y(n) = x^2(n+2)$	**CO1**	**BTL4**	Analyze
5.	For each of the following systems, determine whether (or) not the system is time-invariant**.** **(8+8)** **(i)** $y(n) = nx(n)$ **(ii)** $y(n) = x(2n)$	**CO1**	**BTL 4**	Analyze
6.	Analyze whether the following system is linear, time varying, causal and stable $y(n) = nx^2\ (n)$. **(16)**	**CO1**	**BTL3**	Apply
7.	Distinguish the following with examples. **(6+5+5)** **(i)** Energy vs. power signal **(ii)** Deterministic and Random **(iii)** Periodic and Aperiodic	**CO1**	**BTL3**	Apply
8.	Determine whether each of the following signals is periodic. If the signal is periodic, specify its fundamental period**.** **(8+8)** **(i)** $x(n) = e^{j6\pi n}$ **(ii)** $x(n) = cos\frac{\pi}{3}n + cos\frac{3\pi}{4}n.$	**CO1**	**BTL5**	Evaluate
9.	Determine whether each of the following signals is periodic. If the signal is periodic, specify its fundamental period. **(8+8)** **(i)** $x(n) = e^{j\frac{3}{5}(n+\frac{1}{2})}$ **(ii)** $x(n) = cos\frac{2\pi}{3}n$	**CO1**	**BTL6**	Create

10.	Define energy and power signal. Also examine whether the following signals are energy or power or neither energy nor power signals. **(8+8)** **(i)** $x_1(n) = \left(\frac{3}{2}\right)^n u(n)$ **(ii)** $x_2(n) = \cos\left(\frac{\pi}{6}n\right)$	**CO1**	**BTL3**	Apply
11.	Determine whether the following signals are energy or power or neither energy nor power signals. **(8+8)** **(i)** $x_1(n) = e^{j(\frac{\pi}{2}n+\frac{\pi}{4})}$ **(ii)** $x_2(n) = e^{2n}u(n)$	**CO1**	**BTL5**	Evaluate
12.	Determine whether the following signals are energy or power or neither energy nor power signals. **(8+8)** **(i)** $x_1(n) = \left(\frac{1}{3}\right)^n u(n)$ **(ii)** $x_2(n) = \sin(\frac{\pi}{4}n)$	**CO1**	**BTL3**	Apply
13.	What are the basic operations of signals? Illustrate with an example. **(16)**	**CO1**	**BTL4**	Analyze
14.	Consider the analog signal $x(t) = 3\cos 100\pi t$ **(16)** **(i)** Determine the minimum sampling rate required to avoid aliasing. **(ii)** If the signal is sampled at the rate Fs = 200Hz, what is the discrete time signal obtained after sampling.	**CO1**	**BTL5**	Evaluate
15.	Define Nyquist rate. Compare the merits and demerits of performing sampling using impulse, Natural and Flat-top sampling techniques. **(16)**	**CO1**	**BTL3**	Apply
16.	**(i)** Describe about spectral density and aliasing effect. **(8)** **(ii)** Discuss about the process of quantization and describe how quantization error can be minimized? **(8)**	**CO1**	**BTL4**	Analyze
17.	Summarize about the different type of Digital signal representation with example. **(16)**	**CO1**	**BTL4**	Analyze

UNIT-II DISCRETE TIME SYSTEM ANALYSIS

SYLLABUS

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z transform, application to discrete systems - Stability analysis, frequency response –Convolution – Discrete Time Fourier transform , magnitude and phase representation.

PART –A

Q	Questions	CO level	BT Level	Competence
1.	Define z-transform.	**CO2**	**BTL1**	Remember
2.	What is the region of convergence (ROC) in Z-transform?	**CO2**	**BTL1**	Remember
3.	What are the properties of Region of convergence?	**CO2**	**BTL1**	Remember

4.	Determine the Z-transform the following finite duration signal $x(n) = \{1,2,3,4\}$.	**CO2**	**BTL2**	Understand
5.	State initial value theorem of Z transform.	**CO2**	**BTL1**	Remember
6.	Explain the multiplication property of the z-transform.	**CO2**	**BTL1**	Remember
7.	What is the Z-transform of δ(n)?	**CO2**	**BTL2**	Understand
8.	What is the difference between bilateral and unilateral Z-transform?	**CO2**	**BTL2**	Understand
9.	Calculate the Z-transform of $x(n) = a^n u(n)$.	**CO2**	**BTL2**	Understand
10.	What is the inverse Z-transform? Name two methods to compute it.	**CO2**	**BTL1**	Remember
11.	State the condition for stability using the Z-transform	**CO2**	**BTL2**	Understand
12.	List the methods of evaluating inverse Z-transform.	**CO2**	**BTL1**	Remember
13.	Find the z-transform of digital impulse and digital ramp signal.	**CO2**	**BTL2**	Understand
14.	Write the conditions to define stability in ROC.	**CO2**	**BTL2**	Understand
15.	Define system function.	**CO2**	**BTL1**	Remember
16.	Give the system function H(z) for $y(n) = x(n) + 2x(n-1) - 4x(n-2) + x(n-3)$.	**CO2**	**BTL2**	Understand
17.	State the relation between DTFT and Z-transform.	**CO2**	**BTL1**	Remember
18.	State time reversal property of the Z-transform.	**CO2**	**BTL1**	Remember
19.	State the time-shifting property of Z-transform.	**CO2**	**BTL1**	Remember
20.	Define Fourier transform of a sequence and give its symmetry property.	**CO2**	**BTL1**	Remember
21.	Define discrete-time Fourier transform pair for a discrete sequence.	**CO2**	**BTL2**	Understand
22.	Determine the DTFT of the sequence $x(n) = \{1,-1,1,-1\}$.	**CO2**	**BTL2**	Understand
23.	What are the properties of Fourier transform of a discrete –time aperiodic sequence?	**CO2**	**BTL1**	Remember
24.	Express the relationship between s-plane and z-plane.	**CO2**	**BTL2**	Understand
	PART – B			
1.	State and prove any five properties of z transform. **(16)**	**CO2**	**BTL3**	Apply
2.	Find the Z transform of $x(n) = n^2u(n)$. **(16)**	**CO2**	**BTL3**	Apply
3.	Determine the z transform and its ROC of the discrete time signal $x(n) = a^n u(n) + b^n u(-n-1)$ **(16)**	**CO2**	**BTL3**	Apply
4.	Find Z-transform and ROC of the causal sequence. **(8+8)** **(i)** $x(n) = \{1,0,3,-1,2\}$ **(ii)** $x(n) = \{1,-2,1,3,4\}$	**CO2**	**BTL4**	Analyze
5.	Consider the signal x(n) is given by $x(n) = \left(\frac{1}{2}\right)^n u(n) + \left(\frac{-1}{4}\right)^n u(n)$. Determine $X(z)$ and ROC. **(16)**	**CO2**	**BTL4**	Analyze
6.	Find the Z-transform of the signals **(8+8)** **(i)** $x(n) = (sin\omega_0 n)u(n)$. **(ii)** $x(n) = (cos\omega_0 n)u(n)$.	**CO2**	**BTL4**	Analyze
7.	Find the inverse z transforms of **(16)** $X(z) = \frac{z+0.2}{(z+0.5)(z-1)}$ ROC$\|z\| > 1$ using long division method.	**CO2**	**BTL3**	Apply

8.	Determine the inverse z transform of **(16)** $X(z) = \frac{1+3z^{-1}}{1+3z^{-1}+2z^{-2}}$ ROC$\|z\| > 2$.	**CO2**	**BTL3**	Apply
9.	Using residue method find the inverse Z transform **(16)** $X(z) = \frac{z+1}{(z+0.2)(z-1)}$ ROC$\|z\| > 1$	**CO2**	**BTL4**	Analyze
10.	Find the inverse Z transform of $X(z) = \frac{1}{1-3z^{-1}+2z^{-2}}$ using convolution method. **(16)**	**CO2**	**BTL3**	Apply
11.	Find the impulse response of the system described by difference equation using z-transform. $y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n)$ **(16)**	**CO2**	**BTL4**	Analyze
12.	Find the response of the causal system $y(n) - y(n-1) = x(n) + x(n-1)$ to the input $x(n) = u(n)$ .Test its stability. **(16)**	**CO2**	**BTL5**	Evaluate
13.	Convolute the following two sequences $x_1(n) = \{0,1,4,-2\}$ and $x_2(n) = \{1,2,2,2\}$. **(16)**	**CO2**	**BTL4**	Analyze
14.	Find the linear convolution of $x(n) = \{1,2,3,4,5,6,7\}$ with $h(n) = \{2,4,6,8\}$. **(16)**	**CO2**	**BTL5**	Evaluate
15.	State and Prove the linearity and frequency shifting property of DTFT. **(16)**	**CO2**	**BTL3**	Apply
16.	Determine the frequency response $H(e^{j\omega})$ for the given system and plot magnitude and phase response, $y(n) + \frac{1}{4}y(n-1) = x(n) + x(n\text{-}1)$. **(16)**	**CO2**	**BTL4**	Analyze
17.	Evaluate the frequency response of the system described by system function $H(z) = 1/(1-0.5z^{-1})$ **(16)**	**CO2**	**BTL5**	Evaluate

UNIT-III DISCRETE FOURIER TRANSFORM & COMPUTATION

SYLLABUS

DFT- properties, magnitude and phase representation – Computation of DFT using FFT algorithm – DIT &DIF FFT using radix 2– Butterfly structure.

PART –A

Q	**Questions**	**CO level**	**BT Level**	**Competence**
1.	State circular frequency shift property of DFT.	**CO3**	**BTL1**	Remember
2.	What is zero padding?	**CO3**	**BTL1**	Remember
3.	Find the discrete Fourier transform for δ[n].	**CO3**	**BTL2**	Understand
4.	Estimate the DFT of the signal $x(n) = a^n$	**CO3**	**BTL2**	Understand
5.	Evaluate the 4-point DFT of the sequence $x(n) = \{1,1,-2,-2\}$.	**CO3**	**BTL2**	Understand
6.	Evaluate the 4-point DFT of the sequence $x(n) = \{1,1,0,0\}$.	**CO3**	**BTL2**	Understand
7.	State Parseval's relation for DFT.	**CO3**	**BTL1**	Remember
8.	Compute the number of multiplications and additions for 32-point DFT and FFT.	**CO3**	**BTL2**	Understand
9.	What is the main advantage of FFT?	**CO3**	**BTL1**	Remember
10.	State circular convolution.	**CO3**	**BTL1**	Remember
11.	Obtain the circular convolution of the following sequences $x(n) = \{1,2,1\}$ $h(n) = \{1,-2,2\}$.	**CO3**	**BTL2**	Understand

12.	What is FFT?	**CO3**	**BTL1**	Remember
13.	Draw the basic butterfly flow graph for the computation in the DIT FFT algorithm.	**CO3**	**BTL1**	Remember
14.	What is meant by radix-2 FFT?	**CO3**	**BTL1**	Remember
15.	Draw the flow graph of a 4-point DFT by applying radix-2 DIF-FFT algorithm.	**CO3**	**BTL1**	Remember
16.	Draw the flow graph of a 4-point DFT by applying radix-2 DIT-FFT algorithm.	**CO3**	**BTL1**	Remember
17.	What is the basic operation in DIT algorithm?	**CO3**	**BTL1**	Remember
18.	Draw the basic butterfly diagram for DIF algorithm.	**CO3**	**BTL1**	Remember
19.	Compare DIT radix-2 FFT and DIF radix-2 FFT.	**CO3**	**BTL2**	Understand
20.	What are the applications of FFT algorithm?	**CO3**	**BTL1**	Remember
21.	In eight point decimation in time (DIT), calculate the gain of the signal path that goes from $x(7)$ to $x(2)$.	**CO3**	**BTL2**	Understand
22.	Explain how butterfly structure is helpful in DFT computation?	**CO3**	**BTL2**	Understand
23.	Summarize the information we get from magnitude and phase representation.	**CO3**	**BTL1**	Remember
24.	Discuss about "in-place computation" in FFT algorithm	**CO3**	**BTL2**	Understand
	PART –B			
1.	State and proof any four properties of DFT. **(16)**	**CO3**	**BTL3**	Apply
2.	Find the DFT of a sequence. **(16)** $x[n] = \begin{cases} 1 & for\ 0 \le n \le 2 \\ 0 & otherwise \end{cases}$ $for N = 4.$ Plot its magnitude response.	**CO3**	**BTL4**	Analyze
3.	Determine the DFT of the sequence $x(n) = \begin{cases} \frac{1}{4}, & for\ 0 \le n \le 2 \\ 0, & otherwise \end{cases}$ **(16)**	**CO3**	**BTL4**	Analyze
4.	Find the circular convolution of two finite duration sequences. **(16)** $x_1(n) = \{1, -1, -2, 3, -1\}, \quad x_2(n) = \{1, 2, 3\}$	**CO3**	**BTL5**	Evaluate
5.	By means of DFT and IDFT, determine the sequence $x(n)$ corresponding to the circular convolution of sequences $x_1(n)$ and $x_2(n)$ given by $x_1(n) = \{1,2,3,4\}$ $x_2(n) = \{1,1,2,2\}$. **(16)**	**CO3**	**BTL5**	Evaluate
6.	Find the DFT of a sequence $x[n] = \{1,1,1,1,1,1,1,1\}$ $using$ Decimation- in- Time (DIT) algorithm**.** **(16)**	**CO3**	**BTL3**	Apply
7.	Find the DFT of a sequence $x[n] = \{1,2,3,4,4,3,2,1\}$ $using$ Decimation- in- Time (DIT) algorithm. **(16)**	**CO3**	**BTL3**	Apply
8.	Derive and draw the butterfly diagram for computing 8-point DFT of a sequence $x(n)$ using DIF FFT algorithm. **(16)**	**CO3**	**BTL4**	Analyze
9.	Derive and draw the butterfly diagram for computing 8-point DFT of a sequence $x(n)$ using DIT FFT algorithm. **(16)**	**CO3**	**BTL4**	Analyze
10.	Find the DFT of a sequence $x[n] = \{1,0,0,0,0,0,0,0\}$using Decimation- in- Time (DIT) algorithm. **(16)**	**CO3**	**BTL3**	Apply
11.	Compute the 4-point DFT of the sequence $x(n) = \{0,1,2,3\}$ using DIT and DIF algorithm. **(16)**	**CO3**	**BTL4**	Analyze

12.	Find the DFT of a sequence $x[n] = \{1,2,3,4,4,3,2,1\}$ using Decimation- in-Frequency (DIF) algorithm. **(16)**	**CO3**	**BTL4**	Analyze
13.	Find the IDFT of the sequence $X(k) = \{4, 1-j2.414, 0, 1-j0.414, 0, 1+j0.414, 0, 1+j2.414\}$ using DIF algorithm. **(16)**	**CO3**	**BTL3**	Apply
14.	An 8 point sequence is given by $x(n) = \{2,2,2,2,1,1,1,1\}$, compute 8 point DFT of $x(n)$ by radix 2 DIT FFT. Also analyze its response with respect to magnitude and space spectrum. **(16)**	**CO3**	**BTL4**	Analyze
15.	Consider the sequences: **(8+8)** $x_1(n) = \{0,1,2,3,4\},\ x_2(n) = \{0,1,0,0,0\}\quad and\ s(n) = \{1,0,0,0\}$ **(i)** Determine a sequence $y(n)\ so\ that\ Y(k) = X_1(k)X_2(k)$ **(ii)** Is there a sequence $x_3(n)\ such\ that\ S(k) = X_1(k)X_3(k)$.	**CO3**	**BTL5**	Evaluate
16.	Describe the need for Bit reversal and the Butterfly structure. For a sequence $x(n) = \{4,3,2,1,-1,2,3,4\}$ obtain the 8 point FFT computation using DIT method. **(16)**	**CO3**	**BTL6**	Create
17.	Given $x(n) = n+1, and\ N = 8$, find $X(k)$ using DIT FFT algorithm. **(16)**	**CO3**	**BTL3**	Apply

UNIT-IV DESIGN OF DIGITAL FILTERS

SYLLABUS

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques –Need and choice of windows – Linear phase characteristics. Analog filter design –Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation Warping, pre warping-Frequency transformation

PART –A

Q. No	**Questions**	**CO level**	**BT Level**	**Competence**
1.	Summarize, why digital filters are more useful than analog filters?	**CO4**	**BTL1**	Remember
2.	Distinguish the IIR and FIR filter.	**CO4**	**BTL2**	Understand
3.	What are the different types of structures for realization of IIR systems?	**CO4**	**BTL1**	Remember
4.	Write the advantages and disadvantages of FIR filters.	**CO4**	**BTL1**	Remember
5.	How one can design digital filters from analog filters?	**CO4**	**BTL2**	Understand
6.	Relate under what conditions an FIR filter will exhibit linear phase response.	**CO4**	**BTL2**	Understand
7.	What are the different types of structures for realization of FIR systems?	**CO4**	**BTL1**	Remember
8.	What is bilinear transformation?	**CO4**	**BTL1**	Remember
9.	Point out the limitation of using rectangular window in FIR filter design.	**CO4**	**BTL2**	Understand
10.	Give Hamming window function.	**CO4**	**BTL1**	Remember
11.	What is Gibb's phenomenon?	**CO4**	**BTL1**	Remember

12.	What is the main disadvantage of direct-form realization?	**CO4**	**BTL1**	Remember
13.	Discuss about the pass band and stop band characteristics of Butterworth filter.	**CO4**	**BTL2**	Understand
14.	List the properties of Chebyshev filter.	**CO4**	**BTL2**	Understand
15.	Write the advantages and disadvantages of digital filters.	**CO4**	**BTL1**	Remember
16.	Name the methods that convert the transfer function of analog filter into digital filter.	**CO4**	**BTL1**	Remember
17.	Give the mapping relation for mapping of s-plane to z-plane in bilinear transformation.	**CO4**	**BTL1**	Remember
18.	What is warping effect? Examine its effect on frequency response?	**CO4**	**BTL2**	Understand
19.	What is pre-warping? Conclude what happens, if pre-warping is not employed?	**CO4**	**BTL1**	Remember
20.	What is impulse invariant transformation?	**CO4**	**BTL1**	Remember
21.	Is the given transfer function $H(z) = \frac{1+0.8Z^{-1}}{1-0.9Z^{-1}}$ represents low pass filter or high pass filter. Justify the answer	**CO4**	**BTL2**	Understand
22.	Draw the frequency response of N-point rectangular window.	**CO4**	**BTL1**	Remember
23.	Analyze the need for employing window for designing FIR filter?	**CO4**	**BTL2**	Understand
24.	How do you analyze in selecting the type of filter (IIR/FIR) for an application?	**CO4**	**BTL2**	Understand
	PART –B			
1.	Obtain the direct form I and direct form II realization for the system. $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$. **(16)**	**CO4**	**BTL3**	Apply
2.	Obtain the cascade form and parallel form realization for the system. $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$. **(16)**	**CO4**	**BTL3**	Apply
3.	Show the realization for the following system using cascade form. **(16)** $$H(z) = \frac{\left(1+\frac{1}{3}z^{-1}\right)}{\left(1-\frac{3}{42}z^{-1}+\frac{1}{8}z^{-2}\right)}$$	**CO4**	**BTL5**	Evaluate
4.	Realize the system given by difference equation $y(n) = 0.1y(n-1) + 0.72y(n-2) - 0.252x(n-2)$ in parallel form. **(16)**	**CO4**	**BTL4**	Analyze
5.	**(i)** Determine the direct form realization of system function. **(8)** $H(z) = 1 + 2z^{-1} - 3z^{-2} - 4z^{-3} + 5z^{-4}$ **(ii)** Determine the cascade form realization of system function. **(8)** $H(z) = (1 + 2z^{-1} - z^{-2})(1 + z^{-1} - z^{-2})$	**CO4**	**BTL3**	Apply
6.	Show the realization for the following system using cascade and parallel structures $$H(z) = \frac{\left(1+\frac{1}{4}z^{-1}\right)}{\left(1+\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)}.$$ **(16)**	**CO4**	**BTL4**	Analyze

7.	Design a filter with desired frequency response $$H_d(e^{j\omega}) = e^{-j3\omega} for -\frac{\pi}{4} \le \omega \le \frac{\pi}{4}$$ $$= 0\ for -\frac{\pi}{4} \le \omega \le \pi$$ Using a Hamming window for N=7. **(16)**	**CO4**	**BTL3**	Apply
8.	Design an ideal low pass filter with a frequency response $$H_d(e^{j\omega}) = \begin{cases} 1 \quad for -\frac{\pi}{2} \le \omega \le \frac{\pi}{2} \\ 0 \quad for \frac{\pi}{2} \le \lvert\omega\rvert \le \pi \end{cases}$$ Find $H(z)$ and the filter coefficients for N=11. **(16)**	**CO4**	**BTL4**	Analyze
9.	Using rectangular window technique design a LPF with pass band gain of unity, cut-off frequency of 1000Hz and working sampling frequency of 5kHz. The length of impulse is 7. **(16)**	**CO4**	**BTL5**	Evaluate
10.	Given the specifications $\propto_p = 3dB,\ \propto_s = 10dB\ \ f_p = 1kHz\ and\ f_s = 2kHz$. Determine the order of the filter using Chebyshev approximation. Find $H(s)$. **(16)**	**CO4**	**BTL3**	Apply
11.	Design an Analog Butter Worth filter that has -2dB pass band attenuation at a frequency of 20rad /sec and at least -10dB stop band attenuation at 30 rad/sec**. (16)**	**CO4**	**BTL5**	Evaluate
12.	**(i)** Illustrate the bilinear transformation method of obtaining digital filter from analog filter. **(8)** **(ii)** Illustrate impulse invariant method of designing IIR filter. **(8)**	**CO4**	**BTL4**	Analyze
13.	Using impulse variance method with T =1 Sec. Compute $H(z)$ if $H(s) = \frac{1}{s^2+\sqrt{2}s+1}$ **(16)**	**CO4**	**BTL4**	Analyze
14.	Apply bilinear transformation to $H(s) = \frac{2}{(s+1)(s+2)}$ with T=1sec and compute $H(z)$. **(16)**	**CO4**	**BTL3**	Apply
15.	Apply impulse variance method to $H(s) = \frac{2}{(s+1)(s+2)}$ with T=1sec and compute $H(z)$. **(16)**	**CO4**	**BTL3**	Apply
16.	Convert the following analog transfer function into digital by applying impulse invariant technique with sampling period T=1 sec $H(z) = s + \frac{1}{(s+3)(s+5)}$ **(16)**	**CO4**	**BTL4**	Analyze
17.	Design a Butterworth filter using the Impulse invariance method for the following specifications. $$0.8 \le \lvert H(e^{j\omega})\rvert \le 1 \quad 0 \le \omega \le 0.2\pi$$ $$\lvert H(e^{j\omega})\rvert \le 0.2 \quad 0.6\pi \le \omega \le \pi$$ **(16)**	**CO4**	**BTL3**	Apply

UNIT-V DIGITAL SIGNAL PROCESSOR

SYLLABUS

Introduction –Architecture of DSP processor – Features-Addressing formats-Functional modes-Introduction to commercial processor.

PART –A

Q.No	Questions	CO level	BT Level	Competence
1.	What is a Digital Signal Processor (DSP)?	CO5	BTL1	Remember
2.	List any two applications of DSP.	CO5	BTL2	Understand
3.	Define the term real-time processing.	CO5	BTL1	Remember
4.	What is the difference between a general-purpose processor and a DSP?	CO5	BTL1	Remember
5.	Why are DSPs preferred over microcontrollers for signal processing?	CO5	BTL2	Understand
6.	Mention two features of DSP architecture.	CO5	BTL2	Understand
7.	What is the role of the Multiply-Accumulate (MAC) unit in DSP?	CO5	BTL2	Understand
8.	Define pipelining in DSP.	CO5	BTL1	Remember
9.	What is the function of the program memory in a DSP?	CO5	BTL2	Understand
10.	Write about circular buffer in DSP.	CO5	BTL1	Remember
11.	What is modulo addressing?	CO5	BTL2	Understand
12.	Mention any two special addressing modes used in DSPs.	CO5	BTL1	Remember
13.	What is the purpose of auxiliary registers in DSP?	CO5	BTL2	Understand
14.	Define Harvard architecture.	CO5	BTL1	Remember
15.	What is the role of the Multiply-Accumulate (MAC) unit in DSP?	CO5	BTL1	Remember
16.	Define pipelining in DSP.	CO5	BTL2	Understand
17.	Give the function of the program memory in a DSP?	CO5	BTL1	Remember
18.	What is meant by instruction pipelining?	CO5	BTL2	Understand
19.	Define parallel processing in DSP.	CO5	BTL1	Remember
20.	What is register file in DSP architecture?	CO5	BTL2	Understand
21.	Give the various factor influence selection of DSPs.	CO5	BTL2	Understand
22.	List the are applications of DSPs.	CO5	BTL1	Remember
23.	List the classification of digital signal processors.	CO5	BTL1	Remember
24.	Why Linear and Time Invariant(LTI) systems are widely used in digital signal processing applications	CO5	BTL2	Understand

PART –B

Q.No	Questions	CO level	BT Level	Competence
1.	Summarize about the types of DSP processors . **(16)**	CO5	BTL4	Analyze
2.	**(i)** Elaborate about the classifications of DSP processors . **(8)** **(ii)** Summarise about the applications of PDSPS. **(8)**	CO5	BTL4	Analyze
3.	Describe the different applications of Programmable (PDSP)? **(16)**	CO5	BTL4	Analyze
4.	Explain about the following **(i)**Van Neuman Architecture **(8)** **(ii)** Harvard Architecture **(8)**	CO5	BTL3	Apply
5.	Explain about VLIW architecture and also give advantages and disadvantages **(16)**	CO5	BTL3	Apply

6.	Explain about **(8+8)** **(i)** Multiply Accumulate unit (MAC)unit **(ii)** Pipeling in DSP	**CO5**	**BTL4**	Analyze
7.	Draw and explain the architecture of TMS320C50 processor . **(16)**	**CO5**	**BTL3**	Apply
8.	Describe about the addressing modes of TMS320C50 processor with example . **(16)**	**CO5**	**BTL4**	Analyze
9.	Explain about the instruction set of TMS320C50 processor with example. **(16)**	**CO5**	**BTL4**	Analyze
10.	Draw and explain the architecture of TMS320C54x processor. **(16)**	**CO5**	**BTL3**	Apply
11.	Explain pipelining (stages and importance) and compare Von Neumann vs Harvard architectures. **(16)**	**CO5**	**BTL4**	Analyze
12.	Describe with a neat diagram the generic internal architecture of a DSP processor and explain the function of the main components. **(16)**	**CO5**	**BTL3**	Apply
13.	Summarize the onchip peripherals of TMS320C54x processor. **(16)**	**CO5**	**BTL3**	Apply
14.	**(i)** Explain the functional blocks of TMS320C50 CPU. **(8)**	**CO5**	**BTL4**	Analyze
	(ii) List any six major features of digital signal processors. **(8)**	**CO5**		
15.	Design a DSP based system for the process of audio signals in an audio recorder system. **(16)**	**CO5**	**BTL4**	Analyze
16.	Elaborate on Radar signal processing using a DSP Processor. **(16)**	**CO5**	**BTL5**	Evaluate
17.	Describe about the different commercial DSP Processors in details. **(16)**	**CO5**	**BTL4**	Analyze