UNIT–I

Introduction to Digital Signal Processing

S. No		Questions	CO	PO
1		Compare symmetric and anti-symmetric signals.	CO1	PO1,PO2,PO4
3		Describe a Liner Time Invariant system?	CO1	PO1,PO2,PO4
4		Illustrate “decimation" and" down sampling"?	CO1	PO1,PO2,PO4
5		State the condition for causality and stability?	CO1	PO1,PO2,PO4
6		Explicit about energy and power signals?	CO1	PO1,PO2,PO4
7		Identify a time- variant system. $y(n)=e^{x(n)}$ $y(n)=x(n^2)$	CO1	PO1,PO2,PO4
8		List out the Applications of Digital Signal Processing?	CO1	PO1,PO2,PO4
9		Prove the following are linear or nonlinear: a) $y(n)=e^{x(n)}$ b) $y(n)=x^2(n)$ c) $y(n)=ax(n)+b$ d) $y(n)=x(n^2)$	CO1	PO1,PO2,PO4
10		Discuss the advantages of Digital Signal Processing?	CO1	PO1,PO2,PO4
11	a)	Express stable and unstable system test the condition For stability of the first-order system governed by the equation y (n) =x(n) +b x(n-1).	CO1	PO1,PO2,PO4
	b)	A system is described by the difference equation Y (n)-y(n-1)-y(n-2)= x(n-1). Assuming that the System is initially relaxed, determine its unit sample response h(n).	CO1	PO1,PO2,PO4
12	a)	Calculate the impulse response and the unit step Response of the systems described by the difference equation y(n)=0.6y(n-1)-0.08y(n-2)+x(n).	CO1	PO1,PO2,PO4
	b)	The impulse response of LTI system is h(n)={121-1}Solve the response of the system if input Is x(n)={1231}	CO1	PO1,PO2,PO4
13	a)	Obtain the output y(n) of LTI system with impulse Response $h(n)=a^nu(n)$. $\lvert a \rvert <1$ When the input is unit input sequence that is x(n)=u(n)	CO1	PO1,PO2,PO4
	b)	Obtain impulse response for cascade of two LTI systems having Impulse responses of$H_1(n)=(1/2)^nu(n)$and$H_2(n)=(1/4)^nu(n)$	CO1	PO1,PO2,PO4

14	a)	Obtain the stability of the system y(n)-(5/2)y(n-1)+y(n-2)=x(n)-x(n-1)	CO1	PO1,PO2,PO4
	b)	Solve the response of the following difference equation y(n)-5y(n-1)+6y(n-2)=x(n) for x(n)=n	CO1	PO1,PO2,PO4

15	a)	Obtain the output y(n) of a filter whose impulse Response is h(n)={111} and input signal x(n)={3-10 1 32 0121}.Using overlap save method	CO1	PO1,PO2,PO4
	b)	Impulse response is h(n)={1,1,1}and Input signal x(n)={2,-1,0,1,4,2,0,1,2,1}determine overlap add method.	CO1	PO1,PO2,PO4
16	a)	Given two sequences of length N obtain expression to compute circular convolution these sequences. List out changes required if circular convolution output same as linear convolution output with example.	CO1	PO1,PO2,PO4
	b)	Obtain the expression for interpolation by factor I	CO1	PO1,PO2,PO4

UNIT –II

DISCRETE FOURIER SERIES

S.No		Questions	CO	PO
1		Draw Radix-2DITFFT and DIFFFT Butterfly diagrams	CO2	PO1,PO2,PO4
2		List out the applications of FFT algorithm	CO2	PO1,PO2,PO4
3		Distinguish between DTFT and DFT with examples	CO2	PO1,PO2,PO4
4		Compare and contrast between Decimation in Frequency Transform (DIF) and Decimation in Time (DIT)algorithms	CO2	PO1,PO2,PO4
5		State about the place computation in DIT FFT and DIF FFT algorithm?	CO2	PO1,PO2,PO4
6		Analyze the concept of zero padding where the result from linear convolution and circular convolution are same?	CO2	PO1,PO2,PO4
7		Describe the disadvantage of direct computation of DFT	CO2	PO1,PO2,PO4
8		Compare the DFT and FFT with examples	CO2	PO1,PO2,PO4
9		List out the properties of twiddle factor?	CO2	PO1,PO2,PO4
10		Establish the relation between DFT and Z	CO2	PO1,PO2,PO4
11	a)	List out FFT advantages? Obtain speed Improvement factor for calculating the 64 DFT of sequence using direct computation and FFT algorithm?	CO2	PO1,PO2,PO4
	b)	Find the DFT of a sequence x(n)={1,2,3,4,4,3,2,1} using DIT FFT algorithms	CO2	PO1,PO2,PO4
12	a)	Describe Radix-2 DIT-FFT algorithm. Compare it with DIF-FFT algorithms.	CO2	PO1,PO2,PO4
	b)	Developan8pointDIT-FFTalgorithm. Draw the signal flow graph.	CO2	PO1,PO2,PO4
13	a)	Compute 4-point-DFT of a sequence x(n)={0,1,2,3}using DITFFT and DIFFFT algorithms	CO2	PO1,PO2,PO4
	b)	Find the DFT of a sequence x(n)={1,1,0,0} And find the IDFT of Y(k)={1,0,1,0}	CO2	PO1,PO2,PO4

14	a)	An8-pointsequenceisgivenbyx(n)={2,2,2,2,1,1,1,1} compute 8-point DFT of x(n)byRadix-2 DIF Algorithm	CO2	PO1,PO2,PO4
	b)	Find the IDFT of the sequence X(K)={7,-0.707-j0.707,-j,0.707-j0.707,1,0.707+j0.707,j,-0.707+j0.707} Using DIT FFT Algorithm	CO2	PO1,PO2,PO4
15	a)	Calculate the IDFT using DIF FFT algorithm given that X (k) = { 4, 1-j2.414, 0, 1-j0.410,0,1+jo.414,0, 1+j2.414}.	CO2	PO1,PO2,PO4
	b)	The 4-point DFT of 4-point sequence x(n)given by X(k)={10,-2+j2,-2,-2- j2}without computing DFT and IDFT determine DFT of following/	CO2	PO1,PO2,PO4
16	a)	Calculate DFT of following sequence $x(n)$for N=4 and N=8 and plot magnitude of DFT X (k) and comments on results obtained. $x(n) = \begin{cases} 1 & for\ 0 \le n \le 2 \\ 0 & for\ other\ wise \end{cases}$	CO2	PO1,PO2,PO4
	b)	Obtainan8pointDFTofthesequence x(n)=(1, 0, 1, -1, 1, -1, 0, 1).	CO2	PO1,PO2,PO4

UNIT–III

IIR DIGITAL FILTERS

S.No	Questions	CO	PO
1	Illustrate the concept of IIR filter and categorize Advantages of IIR filter?	CO3	PO1,PO2,PO4
2	Distinguish between Analog filter and Digital filters	CO3	PO1,PO2,PO4
3	Analyze designing of IIR Digital filters	CO3	PO1,PO2,PO4
4	Distinguish between Butterworth filters and Chebyshev-Type-1Filter	CO3	PO1,PO2,PO4
5	Demonstrate the transformation of analog filters into Equivalent digital filters	CO3	PO1,PO2,PO4
6	Comparison of IIR and FIR digital filters with real Time examples	CO3	PO1,PO2,PO4
7	Describe Butterworth Filters	CO3	PO1,PO2,PO4
8	Describe Analog Low-pass filter design	CO3	PO1,PO2,PO4
9	Distinguish between the frequency response ofChebyshev-Type-1and Chebyshev-Type-II	CO3	PO1,PO2,PO4

10	Elucidate Analog transformation of prototype LPF to HPF		CO3	PO1,PO2,PO4
11	a)	Describe Transformation of Analog filters into equivalent digital filters using Bilinear transformation method	CO3	PO1,PO2,PO4
	b)	Designa4thorderButterworth-typeIIRlow-pass Digital filter is needed with 3dB cut-off a tone sixteenth of the sampling frequency fS.	CO3	PO1,PO2,PO4
	a)	Design a band stop Butterworth and chebyshev type-1filter to meet the following specifications i) stop band100 to 600Hz, ii) 20dB attenuation at 200 and 400hzthe gain at ω =0 is unity iii) the pass band ripple forchebychevfilteris1.1dBiv) passband attenuation for Butterworthfilteris3 dB.	CO3	PO1,PO2,PO4
	b)	Calculate the impulse-response of the digital filter with $H(z) = \frac{1}{1-2z^{-1}}$	CO3	PO1,PO2,PO4
13	a)	Design a 4th order band- pass filter with ΩL=π/4, Ωu=π/2.	CO3	PO1,PO2,PO4
	b)	Design a 3rd order Butterworth digital filter using Impulse Invariant technique, assume sampling T is 1sec and f or N is 3	CO3	PO1,PO2,PO4
14	a)	Discuss and Explain Bilinear Transformation method, wrapping effect and pre-wrapping ,draw the effect on magnitude response due to wraping effect	CO3	PO1,PO2,PO4
	b)	Apply bilinear transformation to H(s)=2/(s+1)(s+2) With Tis1sec,find H(z).	CO3	PO1,PO2,PO4
15	a)	Design ofa2ndorderIIRlow-passdigitalfilterby The bilinear transform method	CO3	PO1,PO2,PO4
	b)	Design a band stop Butterworth and chebyshev type-1filter to meet the following specifications i) stop band100 to 600Hz, ii) 20dB attenuation at 200 and 400hzthe gain at ω =0 is unity iii) the pass band ripple forchebychevfilteris1.1dBiv)passband attenuation for Butterworthfilteris3 dB.	CO3	PO1,PO2,PO4
16	a)	A Butterworth- type IIR low-pass digital filter is needed with 3dB cut-off at one sixteenth of the sampling frequency fs , and a stop-band attenuation of at least 24dB for all frequencies above fs/8. (i)What order is needed? (b)Design it.	CO3	PO1,PO2,PO4
	b)	Develop Analog Low pass Chebyshev Filters Including type I and type-II	CO3	PO1,PO2,PO4

UNIT–IV

FIR DIGITAL FILTERS

S.No		Questions	CO	PO
1		Express Gibbs phenomenon?	CO4	PO1,PO2,PO3,PO4
2		List out the desirable characteristics of the windows?	CO4	PO1,PO2,PO3,PO4
3		Compare Hamming window with Kaiser window.	CO4	PO1,PO2,PO3,PO4
4		State the effect of truncating an infinite Fourier series into a finite series	CO4	PO1,PO2,PO3,PO4
5		Justify FIR filters are always stable?	CO4	PO1,PO2,PO3,PO4
6		Draw the frequency response of N point Bartlett window	CO4	PO1,PO2,PO3,PO4
7		Give the equation specifying Kaiser window.	CO4	PO1,PO2,PO3,PO4
8		Compare IIR and FIR filters	CO4	PO1,PO2,PO3,PO4
9		State conditions a finite duration sequence h(n) will yield constant group delay in its frequency response Characteristics and not the phase delay?	CO4	PO1,PO2,PO3,PO4
10		What is the necessary and sufficient condition for Linear phase characteristics in FIR filter	CO4	PO1,PO2,PO3,PO4
11	a)	Design an ideal high pass filter with a frequency response $H_d(ejw)=1$ for $\leq\|\omega\|\leq\pi$ 0 for $\|\omega\|\leq$ Find the values of h(n) for N=11. Find H(z). plot magnitude response.	CO4	PO1,PO2,PO3,PO4
	b)	Design an ideal high pass filter with a frequency response $Hd(ejw)=1$for $\leq\|\omega\|\leq\pi$ 0 for$\|\omega\|\leq$ Find the values of h(n) for N=11 . Find H(z). Plot magnitude response.	CO4	PO1,PO2,PO3,PO4
12	a)	Design an ideal differentiator $H(ejw)=j\omega$ $-\pi\leq\omega\leq\pi$ Using a) rectangular window b)Hamming window With N=8.plot frequency response in both cases.	CO4	PO1,PO2,PO3,PO4

	b)	Design a high pass filter Using Hanning Window With a cut-off frequency of 1.2radians/second and N=9	CO4	PO1,PO2,PO3,PO4
13	a)	Design an ideal band reject filter with a frequency response Hd(ejw) =1 for $\|\omega\| \leq$and $|\omega| \geq$0 for otherwise Find the values of h(n) for N=11.FindH(z).plot	CO4	PO1,PO2,sPO3,PO4
	b)	Calculate the frequency response of FIR filter defined by y(n)=0.25x(n)+x(n-1)+.25x(n-2) Calculate the Phase delay and group delay.	CO4	PO1,PO2,PO3,PO4
14	a)	Prove that an FIR filter has linear phase if the unit sample response satisfies the condition h(n)= ±h(M-1-n),n=0,1,….M1.Also discuss symmetric and antisymmetric cases of FIR filter	CO4	PO1,PO2,PO3,PO4
	b)	Using rectangular window technique design a low pass filter with pass band gain of unity, cutoff frequency of 1000 Hz and working at a sampling frequency of 5kHz.The length of the impulse responseshouldbe7	CO4	PO1,PO2,PO3,PO4
15	a)	Design a tenth order FIR band pass digital filter with lower and upper cut-off frequencies at $\pi/8$ and $\pi/3$respectively.	CO4	PO1,PO2,PO3,PO4
	b)	Design a filter with Hd(ejώ)=e-3jώ,$\pi/4 \leq \omega \leq \pi/4$ =0for$\pi/4 \leq \omega \leq \pi$ Using a Hamming window with N=7.	CO4	PO1,PO2,PO3,PO4
16	a)	Using frequency sampling method design a band pass filter with following specifications Sampling frequency F=8000Hz, Cut off frequencyfc1=1000Hzfc2=3000Hz.Determinethefilter coefficientsfor N=7	CO4	PO1,PO2,PO3,PO4
	b)	Illustrate the principle and procedure for designing FIR filter using Hamming window	CO4	PO1,PO2,PO3,PO4

UNIT–V

REALIZATION OF DIGITAL FILTERS AND FINITE WORD LENGTH EFFECTS

S.No	Questions	CO	PO
1	Compare Fixed and Binary floating point number Representation?	CO5	PO1,PO2,PO3,PO4
2	Evaluate How the multiplication & addition are carried out in floating point arithmetic?	CO5	PO1,PO2,PO3,PO4

3		List out the effects of finite word length in digital Filters?	CO5	PO1,PO2,PO3,PO4
4		List the errors which arise due to quantization process.	CO5	PO1,PO2,PO3,PO4
5		Describe about (a)Truncation and rounding (b)Coefficient Quantization.	CO5	PO1,PO2,PO3,PO4
6		Mention the properties of ROC	CO5	PO1,PO2,PO3,PO4
7		Write the applications of Z transform	CO5	PO1,PO2,PO3,PO4
8		Check whether the given Response is stable or not $x(n) = a^n$	CO5	PO1,PO2,PO3,PO4
9		Illustrate the concept of coefficient quantization in IIR Filter.	CO5	PO1,PO2,PO3,PO4
10		Compare cycle oscillations and signal scaling.	CO5	PO1,PO2,PO3,PO4
11	a)	Evaluate the direct form–I cascade and parallel form for $y(n)+y(n-1)-4y(n-3)=x(n)+3x(n-2)$	CO5	PO1,PO2,PO3,PO4
	b)	Use the one-sided Z-transform to solve $y(n)n\geq 0$in The following cases. (a)$y(n)+y(n-1)-0.25y(n-2)=0; y(-1)=y(-2)=1$ (b) $y(n)-1.5y(n-1)+0.5y(n-2)=0; y(-1)=1; y(-2)=0$	CO5	PO1,PO2,PO3,PO4
12	a)	Obtain the transfer function and impulse response of The system $y(n)-\frac{3}{4}y(n-1)+\frac{1}{8}y(n-2)=x(n)+\frac{1}{3}x(n-1)$.	CO5	PO1,PO2,PO3,PO4
	b)	Solve the inverse Z-transform of $X(z)=\frac{z(z+1)}{(z-2)(z-1)^3}$ Roc $\|z\|>2$usingpartialfraction method.	CO5	PO1,PO2,PO3,PO4
13	a)	Obtaintheimpulseresponseandstepresponseofthecausalsystemgivenbelowanddiscussonstability: $y(n)+y(n-1)-2y(n-2)=x(n-1)+2x(n-2)$	CO5	PO1,PO2,PO3,PO4
	b)	Discuss in detail the errors resulting from rounding And truncation.	CO5	PO1,PO2,PO3,PO4
14	a)	The output of an A/D is fed through a digital System whose system function is $H(z)=1/(1-0.8z^{-1})$. Calculate the output noise power of the digital system.	CO5	PO1,PO2,PO3,PO4
	b)	Describe about the limit cycle oscillations due to product round off and overflow errors.	CO5	PO1,PO2,PO3,PO4
15	a)	Elucidate about quantization of analog signals? Derive the expression for the quantization error.	CO5	PO1,PO2,PO3,PO4

	b)	Explore about quantization effecting ADC of signals .Derive the expression for Pe(n) and SNR.	CO5	PO1,PO2,PO3,PO4
16	a)	A digital system is characterized by the difference Equation y(n)=0.95y(n-1)+x(n). Determine the dead band of the system when x(n)=0 and y(-1)=13.	CO5	PO1,PO2,PO3,PO4
	b)	1) State the various common methods of Quantization. 2) Describe the finite word length effects in FIR digital filters	CO5	PO1,PO2,PO3,PO4