Course Code: 16EC422 **R16**

SIDDHARTH GROUP OF INSTITUTIONS:: PUTTUR
(AUTONOMOUS)
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: Digital Signal Processing (16EC422) **Course & Branch**: B.Tech - EEE

Regulation: R16

UNIT –I

REVIEW OF DISCRETE-TIME SIGNALS AND SYSTEMS & DISCRETE FOURIER TRANSFORM

1	a) Explain the classification of discrete time signals and systems. b) Determine the circular convolution for the two sequences $x_1(n)=\{1,2,3,4\}$, $x_2(n)=\{1,5,1,3\}$ using concentric circles method.	[L2][CO1] [L5][CO1]	**[5M]** **[7M]**
2	a) Find impulse response of the system described by the difference equation $y(n)+ y(n-1)-2y(n-2)= x(n-1)+2x(n-2)$. b) Find 4-point DFT of the sequence $x(n)=\{1,6,4,3\}$.	[L2][CO1] [L2][CO1]	**[6M]** **[6M]**
3	a) Determine the linear convolution of following two sequences: $x(n) = \{3,2,1,2\}$; $h(n) = \{1,\underset{\uparrow}{2},1,2\}$ b) Explain the power signal and Energy signal.	[L5][CO1] [L2][CO1]	**[6M]** **[6M]**
4	Find the response of the system described by the difference equation: $y(n)+2y(n-1)+y(n-2)=x(n)+x(n-1)$ for the input $x(n) =\left(\frac{1}{2}\right)^n u(n)$, with initial conditions $y(-1)=y(-2)=1$.	[L1][CO1]	**[12M]**
5	Find the forced response of the system described by the difference equation: $y(n)+ 2y(n-1)+y(n-2)=x(n)+x(n-1)$ for input $x(n) =(-1)^n u(n)$.	[L2][CO1]	**[12M]**
6	State and prove following properties of DFT i)Circular shifting ii)Time reversal iii)complex conjugate iv)Linearity v)Circular convolution	[L5][CO1]	**[12M]**
7	Find the output y(n) of a filter whose impulse response is $h(n)=[1,-1]$ and input $x(n)= [1,-2,2,-1,3,-4,4,-3]$ using i) overlap add method ii)overlap-save method	[L1][CO1]	**[12M]**
8	a) Find 8 point DFT of the sequence $x(n)=[1,2,1,0,2,3,0,1]$ b) Describe the relation between i) DFT to Z- transform ii) DFT to Fourier Series.	[L1][CO1] [L1][CO1]	**[7M]** **[5M]**
9	a) Explain how DFT can used as a linear Transform. b) Find the forced response of the system described by the difference equation: $y(n)+ 2y(n-1)+y(n-2)=x(n)+x(n-1)$ for input $x(n) =(-1)^n u(n)$.	[L2][CO1] [L1][CO1]	**[6M]** **[6M]**
10	a) Explain frequency analysis of discrete-time systems. b) Find the natural response of the system described by difference equation $y(n)+2y(n-1)+y(n-2)=x(n)+x(n-1)$ with initial condition $y(-1)=y(-2)=1$.	[L2][CO1] [L1][CO1]	**[4M]** **[8M]**

UNIT –II
EFFICIENT COMPUTATION OF THE DFT

1	Determine 8-point DFT of the sequence x(n)= {1,2,3,4,4,3,2,1} using radix-2 DIT-FFT Algorithm.	[L5][CO2]	**[12M]**
2	a) Construct Radix-4 DIF FFT algorithm with neat sketch. b) Compare DFT and FFT algorithms.	[L2][CO2] [L4][CO2]	**[6M]** **[6M]**
3	Determine 8-point DFT of the sequence x(n)= {1,2,1,2,1,2,2,1} using radix-2 DIF-FFT Algorithm.	[L5][CO2]	**[12M]**
4	a) Construct the decimation in time FFT algorithm with butterfly diagram. b) Explain use of FFT in linear filtering and correlation.	[L1][CO2] [L2][CO2]	**[6M]** **[6M]**
5	a) With a neat sketch find 4 point DFT of the sequence x(n)=[1,6,7,4] using radix2 DIT-FFT algorithm. b) Interpret the applications of FFT algorithm**.**	[L3][CO2] [L1][CO2]	**[8M]** **[4M]**
6	Develop an 8-point DIF-FFT algorithm. Draw the signal flow graph. Determine the DFT of the following sequence, x(n)= {1,1,1,0,0,1,1,1}.	[L3][CO2]	**[12M]**
7	a) Explain decimation in frequency FFT algorithm. b) Compare radix-2 DIT-FFT and DIF-FFT algorithms.	[L2][CO2] [L4][CO2]	**[6M]** **[6M]**
8	a) Explain Radix-4 FFT algorithm in decimation in time domain. b) Describe Quantization errors in the direct computation of DFT.	[L2][CO2] [L1][CO2]	**[6M]** **[6M]**
9	How do you compute DFT using i) The Goertzel Algorithm ii)The chrip-z Transform.	[L1][CO2]	**[12M]**
10	a) Explain divide and conquer approach to computation of the DFT. b) Explain Radix-4 FFT algorithm with neat butterfly diagram.	[L2][CO2] [L2][CO2]	**[6M]** **[6M]**

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UNIT –III

STRUCTURES FOR THE REALIZATION OF DISCRETE-TIME SYSTEMS

1	(a) Discuss the realization of FIR filter structures. (b) Determine the cascade form realization for the following FIR filter with system function H (z) = 1 + (5/2) z-1+2z-2+2z-3.	[L6][CO3] [L5][CO3]	**[6M]** **[6M]**
2	a) Determine the direct form realization for FIR filter of the following impulse response $h(n) = \delta(n)+1/2\ \delta(n-1)-1/4\ \delta(n-2)+\delta(n-4)+1/3\ \delta(n-3)$. b)Determine the direct form realization for the following linear phase filters h(n) =[1,2,-4,2,3,1,2].	[L5][CO3] [L5][CO3]	**[6M]** **[6M]**
3	a) Explain about lattice structure for FIR systems. b) Determine the lattice structure for the following FIR filter function $H(z) = 1 + 2z^{-1}+1/3\ z^{-2}$.	[L2][CO3] [L5][CO3]	**[6M]** **[6M]**
4	Determine the transfer function H(Z) of an FIR filter to implement $h(n)= \delta(n)+2\delta(n-1)+\delta(n-2)$ using frequency sampling technique.	[L5][CO3]	**[12M]**
5	(a) Explain the advantages and disadvantages of Direct form-II realization. (b) Determine the cascade form realization for IIR system with difference equation y(n) = y(n - 1) + 2y(n - 2) + x(n).	[L2][CO3] [L5][CO3]	**[6M]** **[6M]**
6	Determine a parallel form realization for the following IIR system: $H(Z)= \dfrac{(1+Z^{-1})(1+2Z^{-1})}{(1+1/2\ Z^{-1})(1-1/4\ Z^{-1})(1+1/8\ Z^{-1})}$	[L5][CO3]	**[12M]**
7	Determine the realization for IIR system with following difference equation y(n) = (3/4) y(n-1) – (1/8) y(n-2) + x(n) + (1/3) x(n-1) (i) direct form-I (ii) direct form-II	[L5][CO3]	**[12M]**
8	Determine realization for IIR system with following difference equation y(n) = (3/4) y(n-1) – (1/8) y(n-2) + x(n) + (1/3)x(n-1). (i) cascade form (ii) Parallel form	[L5][CO3]	**[12M]**
9	a) Explain briefly about Signal flow graph & transposed structures with an example. b) Explain about conversion from lattice structure to direct form for IIR systems.	[L2][CO3] [L2][CO3]	**[6M]** **[6M]**
10	Determine the direct form I , direct form-II ,cascade 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).	[L5][CO3]	**[12M]**

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UNIT –IV
IIR FILTER DESIGN

1	(a) Explain about frequency transformation in analog domain. (b) Compare FIR and IIR filters.	[L2][CO4] [L4][CO4]	**[6M]** **[6M]**
2	(a) Discuss about Lowpass to highpass transformation in analog domain (b) Design a highpass filter for the given specifications α_p=3dB; α_s=15dB; Ωp=1000rad/sec and Ωs=500rad/sec.	[L6][CO4] [L6][CO4]	**[6M]** **[6M]**
3	Explain the IIR filter design using approximation of derivatives method. and also Sketch the s-plane to z-plane mapping using approximation of derivatives method.	[L2][CO4]	**[12M]**
4	(a)Explain the design steps of a digital filter using Impulse Invariance method. (b)For the analog transfer function H(s)=2/(s+1)(s+2) determine H(s) using impulse invariance method. Assume T=1 sec.	[L2][CO4] [L5][CO4]	**[5M]** **[7M]**
5	Explain the IIR filter design approximation using Bilinear Transformation method**.** Also sketch the s-plane to z-plane mapping. State its merits and demerits.	[L2][CO4]	**[12M]**
6	Convert the following analog filter transfer function using backward difference method, Impulse invariant method and Bilinear Transformation method. H(s)=1/(s+0.2) Consider T= 1 Sec.	[L6][CO4]	**[12M]**
7	Design a third order Butterworth digital filter using impulse invariant technique. Assume sampling period T=1 sec.	[L6][CO4]	**[12M]**
8	(a) What is bilinear transformation? Mention its properties. (b) Explain about frequency transformation in digital domain.	[L1][CO4] [L2][CO4]	**[5M]** **[7M]**
9	Design an analog Butterworth filter that has a -2db pass band attenuation at a frequency of 20rad/sec and at least -10dB stop band attenuation at 30 rad/sec (assumeΩc = 21.3868 rad/sec).	[L6][CO4]	**[12M]**
10	Design a digital Butterworth filter satisfying the constraints $0.707 \leq \lvert H(e^{j\omega})\rvert \leq 1$ for $0 \leq \omega \leq \pi/2$ $\lvert H(e^{j\omega})\rvert \leq 0.2$ for $3\pi/4 \leq \omega \leq \pi$ with T=1 sec using i) The bilinear Transformation ii) Impulse invariance method.	[L6][CO4]	**[12M]**

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UNIT –V
FIR FILTER DESIGN

1	a) Explain about characteristics of practical frequency selective filters. b) What are the merits and demerits of FIR filters?	[L2][CO5] [L1][CO5]	**[8M]** **[4M]**
2	a) Explain about design of symmetric and asymmetric FIR filters. b) Discuss the frequency selective filters with plot.	[L2][CO5] [L1][CO5]	**[7M]** **[5M]**
3	Design an ideal band pass filter with a frequency response $H_d(e^{jw}) = 1 \quad \pi/4 \le \lvert w \rvert \le 3\pi/4$ $= 0$ otherwise Find the values of h(n)for N=11 and plot frequency response.	[L6][CO5]	**[12M]**
4	Design an ideal HPF with desired frequency response $H_d(e^{jw})=$ 1 for $\pi/4 \le \lvert w \rvert \le \pi$ 0 for $\lvert w \rvert \le \pi/4$ Find the values of h(n) for N=11 and also find H(Z) using Hanning window technique.	[L6][CO5]	**[12M]**
5	Design a FIR low pass filter satisfying the following specifications $\alpha_p \le 0.1$ dB; $\alpha_s \ge 44.0$ dB; ω_p= 20rad/sec; ω_s=600 rad/sec and ω_{sf} =100 rad /sec.	[L6][CO5]	**[12M]**
6	a) Discuss about characteristics linear phase FIR filters. b) Compare features of different windowing functions.	[L2][CO5] [L4][CO5]	**[6M]** **[6M]**
7	a) Explain about design method of optimum equi ripple linear phase FIR filters. b) What are the desirable characteristics of the window?	[L2][CO5] [L1][CO5]	**[8M]** **[4M]**
8	(a) Design FIR filters using symmetric filter. (b) Explain about the Rectangular window of the FIR filter.	[L6][CO5] [L2][CO5]	**[6M]** **[6M]**
9	Design a filter with $H_d(e^{j\omega}) = e^{-j3\omega} \quad -\pi/4 \le \omega \le \pi/4$ $= 0 \quad \pi/4 \le \omega \le \pi$ Using Hamming window with N = 7.	[L6][CO5]	**[12M]**
10	Illustrates the followings i) Rectangular window ii) Hamming window ii) Hanning window	[L1][CO5]	**[12M]**

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