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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)
BANGALORE – 560 054

SEMESTER END EXAMINATIONS – JANUARY 2016

Course & Branch	:	**B.E.- Electrical & Electronics Engg.**	**Semester**	:	**V**
Subject	:	**Digital Signal Processing**	**Max. Marks**	:	**100**
Subject Code	:	**EE501**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT – I

1. a) List the advantages and disadvantages of digital signal processing over analog signal processing? CO1 (06)

b) i) Compute the N point DFT of x(n)=2, 0≤n≤N-1.
(ii) For N=5, compute the DFT of x1(n)={1,0,1,0,1} iii) compute DFT of x2(n)={1,1,1} for N=3. CO1 (06)

c) Let xp(n) be a periodic sequence with fundamental period N. Consider the following DFTs CO1 (08)

$$xp(n) \overset{DFT}{\underset{N}{\longleftrightarrow}} X1(k), \qquad xp(n) \overset{DFT}{\underset{3N}{\longleftrightarrow}} X3(k).$$

What is the relationship between X1(k) and X3(k)?

2 a) Given $x(n)=(\frac{1}{3})^n[u(n)-u(n-3)]$.Determine the following without computing 4 point DFT. CO1 (12)

i) If $G(k)=W_2^k X(k)$,find g(n).

ii) $\sum_{n=0}^{3} X(k).X^*(k)$

iii) $X(0)+X(2)$

b) Compute the circular convolution of the sequences x1(n) and x2(n) using DFT and IDFT method.$x_1(n)$={-2,3,-1,5} and $x_2(n)$={1,2,3,4} and also compute the circular convolution using circular arrays. CO1 (08)

UNIT – II

3. a) Find y(n)=x(n)* h(n) for the sequences x(n)= {1,2,3,1,2,3,1,2,3,1,2,3,1,2,3} and h(n)={1,2,3}. Use overlap save method. Use 4 point convolution. CO1 (10)

b) Find the 8-point DFT of the sequence x(n) = {1/√3, 1, 1/√3, 0, -1/√3, -1, -1/√3,0} using Radix 2 DIF FFT algorithm. CO1 (10)

4. a) The sequence x(n)={1,-2,2,1,1, -3,3,1,1,-4,4,1,1,2,3,4} is filtered though a filter impulse response h(n)={1,-1,2}.compute the output of the filter using overlap add method. Use 5-point circular convolution. CO1 (10)

	b)	Given x(n)={-1,-2,-3,4,3,2,1}, find the DFT X(k) using decimation in time radix 2 FFT algorithm. Show all the intermediate steps.	CO1	(10)

UNIT – III

5.	a)	Give the time domain sketch and the mathematical representation of the following windows: i) Rectangular window ii) Hanning window.	CO2	(08)
	b)	Use the window design method to design a linear phase FIR filter of order N=24 to approximate the following ideal frequency response magnitude: $\lvert H_d(e^{jw})\rvert = \begin{cases} 1, & \lvert w\rvert \le 0.2\pi \\ 0, & 0.2\pi < \lvert w\rvert \le \pi \end{cases}$	CO2	(08)
	c)	Write the procedure for designing FIR filter with an non-causal sequence assumption.	CO2	(04)
6.	a)	Consider the following specifications for a filter $0.95 \le \lvert H(e^{jw})\rvert \le 1.05 \quad 0 \le \lvert w\rvert \le 0.2\pi$ $\lvert H(e^{jw})\rvert \le 0.007 \quad 0.22\pi \le \lvert w\rvert \le 0.75\pi$ $0.95 \le \lvert H(e^{jw})\rvert \le 1.05 \quad 0.8\pi \le \lvert w\rvert \le \pi$ i.Design a linear phase FIR filter to meet these specifications using the window design method. ii.What is the approximate order of the equiripple filter that will meet these specifications?	CO2	(10)
	b)	Describe the theorem for linear phase and discuss the case when h(n) is symmetric about the mid point with 'N' even.	CO2	(10)

UNIT – IV

7.	a)	Develop bilinear transformation ,what are its characteristics?	CO3	(06)
	b)	Design a digital LPF with a passband magnitude characteristic that is constant to within 0.75 dB for frequencies below w=0.2613π and stop band attenuation of atleast 20dB for frequencies between w=0.4018π and π. Determine the transfer function H(Z) for the lowest order butterworth design which meets the specifications. Use bilinear transformation	CO3	(14)
8.	a)	What are the advantages and disadvantages of IIR Filters?	CO3	(06)
	b)	Find the order N of a lowpass Butterworth filter to meet the following specifications. $\delta p = 0.001 \quad \delta s = 0.001$ $\Omega p = 1$ rad/sec $\quad \Omega s = 2$ rad/sec	CO3	(07)
	c)	A second order continuous time filter has the system function Ha(s)= 1/(s-a) + 1/(s-b) where a<0 and b<0 are real. (i)Determine the locations of the poles and zeroes of H(z) if the filter is designed using the bilinear transformation with Ts=2. (ii) Repeat part (i) for the impulse invariance technique again with Ts=2.	CO3	(07)

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UNIT – V

9. a) Consider a second LTI system described by a difference equation CO2 (12)

   y(n)=1/16 y(n-2)+x(n)

   i. Determine the unit sample response h(n) of the system
   ii. Determine DFII, parallel form and cascade form realization of the system
   iii. Find the expression for the frequency response of the system

   b) Given CO3 (08)

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

   i) Direct form realization
   ii) Cascade form realization

10. a) Realize the system function H(Z) in cascade and parallel form CO2 (12)

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

   b) Realize a linear phase FIR filter with the following impulse response. CO3 (08)

   $$h(n)=\partial(n)+\frac{1}{8}\partial(n-1)-\frac{1}{2}\partial(n-2)+\frac{1}{8}\partial(n-3)+\partial(n-4)$$

   Give necessary equations.

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