Code No: RR410201 **RR** **Set No. 2**

IV B.Tech I Semester Examinations,November 2010
DIGITAL SIGNAL PROCESSING
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Determine the frequency response , magnitude response and phase response for the system given by $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) - x(n-1)$

   (b) A causal LTI system is described by the difference equation y(n)=y(n-1)+y(n-2)+x(n-1), where x(n) is the input and y(n) is the output. Find

      i. The system function H(Z)=Y(Z)/X(Z) for the system, plot the poles and zeroes of H(Z) and indicate the region of convergence.
      ii. The unit sample response of the system.
      iii. Is this system stable or not? [6+10]

2. (a) Define a linear-time invariant system in discrete time. Define the terms causality and stability of such systems. Discuss the properties for the following sequences.

$$y(n) = \begin{cases} x(n), for\ n \geq 1 \\ 0,\ for\ n = 0 \\ x(n+1), for\ n \leq -1 \end{cases}$$

   (b) Find the:

      i. impulse response and
      ii. output response for a step input applied at n=0 of a discrete time linear time invariant system whose difference equation is given by y(n) = y(n-1)+0.5 y(n-2)+x(n)+x(n-1). [8+8]

3. (a) Explain the factors that influence the choice of structure for realisation of a LTI system.

   (b) An LTI system is described by the difference equation $y(n) = a_1 y(n-1) + x(n) + b_1 x(n-1)$

   Realize it in direct form I structure and convert it to direct form II structure. [4+12]

4. Design a Digital IIR low pass filter with pass band edge at 1000 Hz and stop band edge at 1500 Hz for a sampling frequency of 5000 Hz. The filter is to have a pass band ripple of 0.5 db and stop band ripple below 30 db. Design Butter worth filler using both impulse invariant and Bilinear transformations. [16]

5. (a) Define Infinite Impulse Response & Finite Impulse Response filters and compare.

(b) Design a low pass Finite Impulse Response filter with a rectangular window for a five stage filter given:
Sampling time 1 msec; $f_c = 200Hz$
Draw the filter structure with minimum number of multipliers. [6+10]

6. (a) Explain the inverse FFT algorithm to compute inverse DFT of a N=8. Draw the flow graph for the same.
   (b) Compute the FFT for the sequence { 1, 0, 0, 0, 0, 0, 0, 0 } [8+8]

7. (a) State and prove the circular time shifting and frequency shifting properties of the DFT.
   (b) Compute the circular convolution of the sequences
   $x_1(n) = \{1, 2, 0, 1\}$ and
   $x_2(n) = \{2, 2, 1, 1\}$ Using DFT approach. [8+8]

8. (a) Let x(n) and $X(e^{jw})$ represent a sequence and its transform. Determine, in terms of $X(e^{jw})$, the transform of each of the following sequences :
      i. k x(n), k = any constant
      ii. $x(n - n_0)$, n_0 = a real integer
   (b) By explicitly evaluating the transforms $X(e^{jw}), H(e^{jw}) and Y(e^{jw})$ corresponding to x(n), h(n) and y(n) specified in part (a) show that $Y(e^{jw}) = H(e^{jw})X(e^{jw})$ [8+8]

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Code No: RR410201 **RR** **Set No. 4**

IV B.Tech I Semester Examinations,November 2010
DIGITAL SIGNAL PROCESSING
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State and prove the circular time shifting and frequency shifting properties of the DFT.

   (b) Compute the circular convolution of the sequences
   $x_1(n) = \{1, 2, 0, 1\}$ and
   $x_2(n) = \{2, 2, 1, 1\}$ Using DFT approach. [8+8]

2. Design a Digital IIR low pass filter with pass band edge at 1000 Hz and stop band edge at 1500 Hz for a sampling frequency of 5000 Hz. The filter is to have a pass band ripple of 0.5 db and stop band ripple below 30 db. Design Butter worth filler using both impulse invariant and Bilinear transformations. [16]

3. (a) Define Infinite Impulse Response & Finite Impulse Response filters and compare.

   (b) Design a low pass Finite Impulse Response filter with a rectangular window for a five stage filter given:
   Sampling time 1 msec; $f_c = 200Hz$
   Draw the filter structure with minimum number of multipliers. [6+10]

4. (a) Define a linear-time invariant system in discrete time. Define the terms causality and stability of such systems. Discuss the properties for the following sequences.

$$y(n) = \begin{cases} x(n), for\ n \geq 1 \\ 0,\ for\ n = 0 \\ x(n+1), for\ n \leq -1 \end{cases}$$

   (b) Find the:

      i. impulse response and
      ii. output response for a step input applied at n=0 of a discrete time linear time invariant system whose difference equation is given by y(n) = y(n-1)+0.5 y(n-2)+x(n)+x(n-1). [8+8]

5. (a) Let x(n) and $X(e^{jw})$ represent a sequence and its transform. Determine, in terms of $X(e^{jw})$, the transform of each of the following sequences :

      i. k x(n), k = any constant
      ii. $x(n - n_0)$, n_0 = a real integer

   (b) By explicitly evaluating the transforms $X(e^{jw}), H(e^{jw}) and Y(e^{jw})$ corresponding to x(n), h(n) and y(n) specified in part (a) show that $Y(e^{jw}) = H(e^{jw})X(e^{jw})$

   [8+8]

6. (a) Determine the frequency response , magnitude response and phase response for the system given by $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) - x(n-1)$
   (b) A causal LTI system is described by the difference equation y(n)=y(n-1)+y(n-2)+x(n-1), where x(n) is the input and y(n) is the output. Find
      i. The system function H(Z)=Y(Z)/X(Z) for the system, plot the poles and zeroes of H(Z) and indicate the region of convergence.
      ii. The unit sample response of the system.
      iii. Is this system stable or not? [6+10]
7. (a) Explain the inverse FFT algorithm to compute inverse DFT of a N=8. Draw the flow graph for the same.
   (b) Compute the FFT for the sequence { 1, 0, 0, 0, 0, 0, 0, 0 } [8+8]
8. (a) Explain the factors that influence the choice of structure for realisation of a LTI system.
   (b) An LTI system is described by the difference equation $y(n) = a_1 y(n-1) + x(n) + b_1 x(n-1)$

      Realize it in direct form I structure and convert it to direct form II structure. [4+12]

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Code No: RR410201 **RR** **Set No. 1**

IV B.Tech I Semester Examinations,November 2010
DIGITAL SIGNAL PROCESSING
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define a linear-time invariant system in discrete time. Define the terms causality and stability of such systems. Discuss the properties for the following sequences.
$$y(n) = \begin{cases} x(n), for\ n \geq 1 \\ 0,\ for\ n = 0 \\ x(n+1), for\ n \leq -1 \end{cases}$$
   (b) Find the:
      i. impulse response and
      ii. output response for a step input applied at n=0 of a discrete time linear time invariant system whose difference equation is given by y(n) = y(n-1)+0.5 y(n-2)+x(n)+x(n-1). [8+8]

2. (a) Define Infinite Impulse Response & Finite Impulse Response filters and compare.
   (b) Design a low pass Finite Impulse Response filter with a rectangular window for a five stage filter given:
   Sampling time 1 msec; $f_c = 200Hz$
   Draw the filter structure with minimum number of multipliers. [6+10]

3. (a) Let x(n) and $X(e^{jw})$ represent a sequence and its transform. Determine, in terms of $X(e^{jw})$, the transform of each of the following sequences :
      i. k x(n), k = any constant
      ii. $x(n - n_0)$, n_0 = a real integer
   (b) By explicitly evaluating the transforms $X(e^{jw}), H(e^{jw}) and Y(e^{jw})$ corresponding to x(n), h(n) and y(n) specified in part (a) show that $Y(e^{jw}) = H(e^{jw})X(e^{jw})$
   [8+8]

4. (a) Explain the inverse FFT algorithm to compute inverse DFT of a N=8. Draw the flow graph for the same.
   (b) Compute the FFT for the sequence { 1, 0, 0, 0, 0, 0, 0, 0 } [8+8]

5. (a) State and prove the circular time shifting and frequency shifting properties of the DFT.
   (b) Compute the circular convolution of the sequences
   $x_1(n) = \{1, 2, 0, 1\}$ and
   $x_2(n) = \{2, 2, 1, 1\}$ Using DFT approach. [8+8]

6. (a) Explain the factors that influence the choice of structure for realisation of a LTI system.
   (b) An LTI system is described by the difference equation $y(n) = a_1 y(n-1) + x(n) + b_1 x(n-1)$
   Realize it in direct form I structure and convert it to direct form II structure. [4+12]

7. (a) Determine the frequency response , magnitude response and phase response for the system given by $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) - x(n-1)$
   (b) A causal LTI system is described by the difference equation y(n)=y(n-1)+y(n-2)+x(n-1), where x(n) is the input and y(n) is the output. Find
      i. The system function H(Z)=Y(Z)/X(Z) for the system, plot the poles and zeroes of H(Z) and indicate the region of convergence.
      ii. The unit sample response of the system.
      iii. Is this system stable or not? [6+10]

8. Design a Digital IIR low pass filter with pass band edge at 1000 Hz and stop band edge at 1500 Hz for a sampling frequency of 5000 Hz. The filter is to have a pass band ripple of 0.5 db and stop band ripple below 30 db. Design Butter worth filler using both impulse invariant and Bilinear transformations. [16]

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Code No: RR410201 **RR** **Set No. 3**

IV B.Tech I Semester Examinations,November 2010
DIGITAL SIGNAL PROCESSING
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define a linear-time invariant system in discrete time. Define the terms causality and stability of such systems. Discuss the properties for the following sequences.

$$y(n) = \begin{cases} x(n), for\ n \geq 1 \\ 0,\ for\ n = 0 \\ x(n+1), for\ n \leq -1 \end{cases}$$

   (b) Find the:

      i. impulse response and
      ii. output response for a step input applied at n=0 of a discrete time linear time invariant system whose difference equation is given by y(n) = y(n-1)+0.5 y(n-2)+x(n)+x(n-1). [8+8]

2. (a) Define Infinite Impulse Response & Finite Impulse Response filters and compare.

   (b) Design a low pass Finite Impulse Response filter with a rectangular window for a five stage filter given:
   Sampling time 1 msec; $f_c = 200Hz$
   Draw the filter structure with minimum number of multipliers. [6+10]

3. (a) Determine the frequency response , magnitude response and phase response for the system given by $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) - x(n-1)$

   (b) A causal LTI system is described by the difference equation y(n)=y(n-1)+y(n-2)+x(n-1), where x(n) is the input and y(n) is the output. Find

      i. The system function H(Z)=Y(Z)/X(Z) for the system, plot the poles and zeroes of H(Z) and indicate the region of convergence.
      ii. The unit sample response of the system.
      iii. Is this system stable or not? [6+10]

4. (a) State and prove the circular time shifting and frequency shifting properties of the DFT.

   (b) Compute the circular convolution of the sequences
   $x_1(n) = \{1, 2, 0, 1\}$ and
   $x_2(n) = \{2, 2, 1, 1\}$ Using DFT approach. [8+8]

5. (a) Explain the factors that influence the choice of structure for realisation of a LTI system.

(b) An LTI system is described by the difference equation $y(n) = a_1 y(n-1) + x(n) + b_1 x(n-1)$

Realize it in direct form I structure and convert it to direct form II structure. [4+12]

6. (a) Let x(n) and $X(e^{jw})$ represent a sequence and its transform. Determine, in terms of $X(e^{jw})$, the transform of each of the following sequences :

   i. k x(n), k = any constant
   ii. $x(n-n_0)$, n_0 = a real integer

   (b) By explicitly evaluating the transforms $X(e^{jw}), H(e^{jw}) and Y(e^{jw})$ corresponding to x(n), h(n) and y(n) specified in part (a) show that $Y(e^{jw}) = H(e^{jw})X(e^{jw})$ [8+8]

7. Design a Digital IIR low pass filter with pass band edge at 1000 Hz and stop band edge at 1500 Hz for a sampling frequency of 5000 Hz. The filter is to have a pass band ripple of 0.5 db and stop band ripple below 30 db. Design Butter worth filler using both impulse invariant and Bilinear transformations. [16]

8. (a) Explain the inverse FFT algorithm to compute inverse DFT of a N=8. Draw the flow graph for the same.

   (b) Compute the FFT for the sequence { 1, 0, 0, 0, 0, 0, 0, 0 } [8+8]

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