Code No: R32043 **R10** **Set No: 1**

III B.Tech. II Semester Regular/Supplementary Examinations, May/June -2014

DIGITAL SIGNAL PROCESSING

(Comm to Electronics and Communication Engineering & Electronics and Computer Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1. a) what is meant by BIBO stability, check the following systems are BIBO stable or not?
   (i) $y(n) = ax(n) + bx^2(n-1)$ (ii) $y(n) = e^{-x(n)}$
   b) Find the Frequency response of Series RL circuit, when it is excited by Sinusoidal wave as input?

2. a) Find the response of the following system with its impulse response $h(n) = \{1,2,4\}$ to an input of $x(n) = \{1,2\}$ using linear convolution and circular convolution?
   b) Give the difference between Linear and Circular convolution and the applications of these?

3. a) Prove that N- point DIT- FFT requires the number of multiplications equal to $Log_2 N$
   b) Compute DFT of the following sequence $x(n) = \cos(n\pi/2)$; $N = 4$ using DIT- FFT algorithm?

4. a) Define $Z-$ transform and give the relation between Z & S Transforms?
   b)What is meant by **ROC** and give some of its properties?
   c) Determine the step response of the following system $y(n) = x(n) - ay(n-1)$ with the initial condition $y(-1) = 1$

5. a) Describe Impulse Invariance method?
   b) Transform the following filter into Digital filter using impulse Invariance method

$$H(S) = \frac{1}{(S^2 + 0.25S + 4)(S + 0.25)}$$

6. a) Define Linear phase, Group delay and Phase delay ?
   b) Design a LPF FIR filter using Rectangular Windowing technique with 11 coefficients find $h(n)$

$$H(e^{i\omega}) = 1 \quad |\omega| \le \pi/2$$
$$H(e^{i\omega}) = 0 \quad \pi/2 \le |\omega| \le \pi$$

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7. a) Explain the advantages of multirate sampling with examples?
   b) Explain With neat diagrams for implementation of polyphase structures?
   c) What is meant by multistage approach and Give the Design procedure for Multirate conversion?

8. Give the architectural block diagram of DSP processor and explain about its important blocks?

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Code No: R32043 **R10** **Set No: 2**

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1. a) Explain about Linearity, causality and time invariance properties of a system?
   b) Find the following systems are linear, causal and time invariant or not?
   i) $\frac{dy(t)}{dt} + y(y) + k = x(t)$
   ii) $y(n) = ax(n)$
   c) What is the importance of Paley Weiner criteria?

2. a) Find the convolution of two finite discrete sequences Using conventional method and Graphical method

$$x(n) = 1 \qquad -1 \le n \le 1$$
$$x(n) = 0 \qquad \text{Elsewhere}$$
$$h(n) = 1 \qquad -1 \le n \le 1$$
$$h(n) = 0 \qquad \text{Elsewhere}$$

   b) Determine DFT of the sequence

$$x(n) = 1/5 \qquad -1 \le n \le 1$$
$$x(n) = 0 \qquad \text{Elsewhere}$$

3. a)Find 8-point DFT of the following sequence using DIT-FFT algorithm
   $x(n) = 2^n; \quad 0 \le n \le 7$
   b) Prove that the number of computations in FFT reduces?

4. a) A causal system has input $x(n)$ and output $y(n)$ find impulse response of the system given
   $x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$
   b) Explain some important properties of **ROC** with diagrams?

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5. a)A Digital LPF is expected to meet the following specifications
   Pass band Ripple $\leq$ 1.5 dB
   Pass band Edge frequency = 5KHz
   Stop band Ripple $\geq$ 50 dB
   Stop band Edge frequency = 25KHz
   What is the lowest order Butter worth and Chebyshev filter to be designed apply Bilinear Transformation, if the sampling frequency is 100 KHz.
   b) Compare Bilinear transformation and Impulse Invariance methods?

6. a) Compare IIR and FIR Filters?
   b) Design an FIR filter having following specifications using Hamming window and find its frequency response

$$H(e^{i\omega}) = e^{j3\omega} \qquad -\pi/4 \leq \omega \leq \pi/4$$

$$H(e^{i\omega}) = 0 \qquad \pi/4 \leq |\omega| \leq \pi$$

7. a) What is meant by multistage approach to sample rate conversion?
   b) Explain about Sample rate reduction by decimation by integer factors with necessary diagrams?
   c) Explain about Sample rate conversion by decimation by non-integer factors with necessary diagrams?

8. Write short critical notes on each of the following concepts, using diagrams where appropriate to illustrate your answer:
   a) Harvard architecture;
   b) Pipelining;
   c) Multiplier-accumulator;
   d) Special instructions;
   e) Data and program memory.

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Code No: R32043 **R10** **Set No: 3**

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DIGITAL SIGNAL PROCESSING

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Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Find the impulse response of the following system, when it is excited by an input $x(n) = 2^{-n}u(n)$, $y(n) - y(n-1) = x(n) + x(n-1)$

   b) What is meant by BIBO stability and check for BIBO stability of the above system?

2. a)Determine the DFT of the sample data sequence $x(n) = \{1,1,2,2,3,3\}$ and compute the corresponding amplitude and phase response?

   b) State and prove time shifting property of DFT

3. a)Find 8-point DFT of the following sequence using DIT-FFT algorithm $x(n) = n+1; \quad 0 \le n \le 7$

   b) compare DIT and DIF algorithms?

4. a) Find $Z-$ Transform of $x(n) = -a^n u(-n-1)$ and indicate its ROC in Z plane?

   b) A Digital filter has input and output given by the following equations, realize the system in parallel form

   $$x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$$

   $$y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$$

5. a)Design a Digital LPF is expected to meet the following specifications with sampling frequency of 200 KHz

   Pass band Ripple =-2 dB

   Pass band Edge frequency = 5KHz

   Stop band Ripple = -40 dB

   Stop band Edge frequency = 100 KHz

   Using impulse invariance method using butter worth approximation?

   b) Compare Butter worth and Chebyshev filter designs?

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6. a) Give the design procedure for designing FIR filters using Fourier Transform method and Windowing techniques?

   b) Design an FIR filter having following specifications using Hamming window and find its frequency response

   $H(e^{i\omega}) = e^{j3\omega}$ $\quad -\pi/4 \le \omega \le \pi/4$

   $H(e^{i\omega}) = 0$ $\quad \pi/4 \le |\omega| \le \pi$

7. a) Explin the advantages of multirate sampling with examples?
   b)Explain With neat diagrams for implementation of polyphase structures?
   c)What is meant by multistage approach and Give the Design procedure for Multirate conversion.

8. a)A multiplier-accumulator, with three pipe stages, is required for a digital signal processor. Sketch a block diagram of a suitable configuration for the MAC. Explain, briefly , and with the aid of a timing diagram, how your MAC works.
   b)Explain why traditional measures such as processor clock speed, MIPS and MFLOPS may not be suitable for comparing the execution performance of DSP processor. Suggest, with justification, an alternative method of comparing execution performance.

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Code No: R32043 **R10** **Set No: 4**

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Time: 3 Hours **Max Marks: 75**

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1. a) Find the response of the following system when it is excited by unit step input $x(n)=u(n)$, $y(n)-5y(n-1)+6y(n-2)=x(n)$
   b) Explain about Linearity, causality and time invariance properties of a system?

2. a)State and prove Multiplicative property in Time domain and Parseval's Theorem?
   b) Define DFT and DFS and comment about their spectra's?
   c) Define IDFT and find IDFT of the given sequence $X(K)=\{1,2,3,4\}$

3. a) Find IDFT of the following sequence using FFT $X(K)=\{1,1,1,1,0,0,0,0\}$
   b) find $X(3)$ in the following sequence $x(n)=\{1,3,5,3\}$

4. a) Realize the following system using minimum number of multiplications in cascaded form
$$H(Z)=[1+\frac{3}{4}Z^{-1}+Z^{-2}][1-\frac{1}{4}Z^{-1}+Z^{-2}]$$
   b) Find $Z-$Transform of the given function $x(n)=na^{n}u(n)$ using properties?

5. a)Design a Digital LPF is expected to meet the following specifications with sampling frequency of 200 KHz
   Pass band Ripple =-2 dB
   Pass band Edge frequency = 5KHz
   Stop band Ripple = -40 dB
   Stop band Edge frequency = 100 KHz
   Using impulse invariance method using butter worth approximation?
   b) Compare Butter worth and Chebyshev filter designs?

6. a) Explain about Keiser window and give its time domain and frequency domain descriptions?
   b) Design a LPF FIR filter using Rectangular Windowing technique with 11 coefficients find $h(n)$
$$H(e^{i\omega})=1 \qquad |\omega|\le \pi/2$$
$$H(e^{i\omega})=0 \qquad \pi/2 \le |\omega| \le \pi$$

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7. a) What is meant by multistage approach to sample rate conversion?
   b)Explain about Sample rate reduction by decimation by integer factors with necessary diagrams?
   c)Explain about Sample rate conversion by decimation by non-integer factors with necessary diagrams?

8. In relation to DSP processor, write brief explanatory notes, with the aid of sketches where appropriate, for each of the following techniques.

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