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COLLEGE OF ENGINEERING GUINDY CAMPUS::ANNA UNIVERSITY CHENNAI

B.E. DEGREE EXAMINATIONS APRIL/MAY 2011

25

Fourth Semester

Electrical and Electronics Engineering

EE 9254 Digital Signal Processing

Answer ALL Questions

Max marks: 100 Time: 3 Hrs

Part-A (10x2=20)

1. Define causality with example.
2. What is meant by frequency warping?
3. State the convolution theorem.
4. Write and prove any two properties of DFT.
5. What is the necessary and sufficient condition on the impulse response for stability?
6. Write the condition to be satisfied for linear phase FIR filter.
7. Define and explain the properties of ROC principle of Z transforms.
8. State two advantages of FFT computation.
9. Calculate the multiplication reduction factor, α in computing 1024 point DFT, by radix-2 FFT algorithm.
10. Find the order and poles of Butterworth LPF that has 3 dB bandwidth of 500 Hz and an attenuation of 40 dB at 1000 Hz.

Part-B (5x16=80)

11. a) (i)The impulse response of an LTI system is $h(n) = \{1, 2, 1, -1\}$. Find the response of system to an input signal $x(n) = \{1, -1\}$. [8]

ii) Determine the response of a system define by the difference equation $y(n) = [5/6]\, y(n-1) - [1/6]y(n-2) + x(n)$ to the input signal $x(n) = \delta(n) - [1/3]\, \delta(n-1)$ using Z-transform. [8]

12. a) Determine the Z transform of the two sided signal $x(n) = \alpha^n u(n) - \beta^n u(-n-1)$ and explain the ROC of this signal in different cases of n variation. [16]

[OR]

b) (i) Obtain the inverse Z transform of X(z). [8]

$X(z) = z^2/(z-0.25)(z-0.1)$

(ii) Realize the following system by cascade form. [8]

$X(z) = (z+1)/(3z^2-4z+1)$

13. a) By means of DFT and IDFT, determine the response of an FIR filter with impulse response $h(n) = \{3, 2, 1\}$ to the input sequence $x(n) = \{2, 1, 2, 1\}$ and plot the frequency spectrum. [16]

[OR]

b) Compute the 8-point DFT of sequence
$x(n) = \{1/3, 1/3, 1/3, 1/3, 0, 0, 0, 0\}$ using the radix-2 DIF-FFT algorithm. [16]

14. a) i) An analog filter has transfer function $H(s) = 8/(s^2+8s+16)$. Design a digital filter equivalent to this function using impulse invariant method of mapping, if $T = 0.35$ sec. [6]

ii) Design a Butterworth low pass filter using the impulse variance method for the following specifications id $T = 1.2$ s. [10]

$0.75 \leq |H(e^{j\omega})| \leq 1 \qquad 0 \leq \omega \leq 0.275\pi$

$|H(e^{j\omega})| \leq 1 \qquad 0.85\pi \leq \omega \leq \pi$

[OR]

b) i) Derive the relationship between the frequencies of s and z domains by using bilinear transformation.

[6]

ii) Design an FIR low pass filter using Hamming window for the following specifications:

$N = 11$, $\omega c = 1$ kHz and $Hd(e^{j\omega}) \{ = e^{-j2\omega}$; $-\pi/4 \leq \omega \leq \pi/4$

$= 0$; $\pi/4 < \omega \leq \pi$ [10]

15. a) Discuss in detail, about the architectural features of any one type of fixed point *DSP* architecture with neat sketches. [16]

[OR]

b) Explain the basic addressing modes of *TMS 320 C 54 XX* processor with examples. [16]
