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Question Paper Code : 81322

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth Semester

Electrical and Electronics Engineering

EC 2314 — DIGITAL SIGNAL PROCESSING

(Regulations 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is quantization error?

2. What is Nyquist rate of the analog signal?

3. Determine the Z-transform and ROC for the signal $x(n) = \delta(n-k) + \delta(n+k)$.

4. Prove the convolution property of z-transform.

5. Differentiate IIR and FIR filter.

6. Give relationship between DTFT and Z transform. What is meant by quantization ever?

7. Realize the filter $H(z) = \dfrac{(z^{-1} - a)(z^{-1} - b)}{(1 - az^{-1})(1 - bz^{-1})}$ in cascade form.

8. Determine the impulse response of an ideal low pass filter given by
$H_d(e^{jw}) = 1, \quad 0 \le |w| \le w_c$
$= 0, \qquad otherwise$.

9. List any two special features of DSP architecture.

10. Give examples for fixed point processor and floating point processor.

PART B — (5 × 16 = 80 marks)

11. (a) Check the following systems are linear, causal, time in variant, stable, static.

(i) $y(n) = x\left(\frac{1}{2n}\right)$

(ii) $y(n) = \sin(x(n))$

(iii) $y(n) = x(n)\cos(x(n))$

(iv) $y(n) = x(-n+5)$

(v) $y(n) = x(n) + nx(n+2)$. (16)

Or

(b) Compute linear and circular convolution of the two sequences $x_1(n) = \{1,2,2,2\}$ and $x_2(n) = \{1,2,3,4\}$. (16)

12. (a) (i) Determine the one sided Z transform of (8)

$y(n) + 1/2\,y(n-1) - 1/4\,y(n-2) = 0;\ y(-1) = y(-2) = 1$.

(ii) An anti causal signal x(n) is given by

$$x(n) = -a^n u(-n-1) = \begin{cases} 0 & n \geq 0 \\ -a^n & n < 0 \end{cases}$$

Determine the z transform and ROC. (8)

Or

(b) (i) Consider a signal x(n) is given by

$x(n) = (1/2)^n u(n) + (-1/4)^n u(n)$, determine $x(z)$ and ROC. (8)

(ii) Determine the inverse z transform of the following z domain functions. (8)

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

(2) $(z - 0.4)/(z^2 + z + 2)$.

13. (a) (i) Prove the Periodicity and Time reversal properties of Discrete Time Fourier Transform. (8)

(ii) Determine and plot the magnitude and phase response of three point moving average system given by $y(n) = \frac{1}{3}[x(n+1) + x(n) + x(n-1)]$. (8)

Or

(b) (i) Obtain eight point discrete Fourier Transform of the input sequence $x(n)=\{1,1,1,1,1,1,1,1\}$ using decimation in frequency Fast Fourier Transform algorithm. (10)

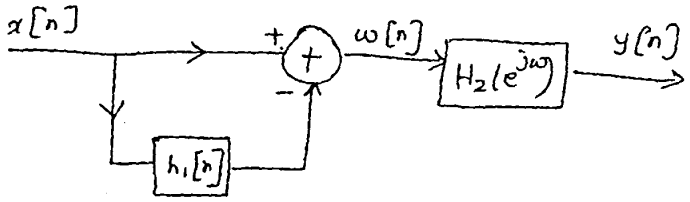
(ii) How is the FFT algorithm applied to determine inverse discrete Fourier transform. (6)

14. (a) Design and realize a digital filter Using bilinear transformation for the following specifications Monotonic pass band and stop band –3.01 dB cut off at 0.5 π rad magnitude down atleast 15dB at w = 0.75π rad. (16)

Or

(b) (i) Consider the causal linear shift invariant filter with system function $H(z)=\frac{1+0.875z^{-1}}{\left(1+0.2z^{-1}+0.9z^{-2}\right)\left(1-0.7z^{-1}\right)}$. Draw the structure using a parallel interconnection of first and second order systems. (8)

(ii) Consider the following interconnection of a linear shift invariant System.



Where $x[n]=\delta[n]$

$h_1[n]=\delta[n-1]$

$H_2\left(e^{jco}\right)=\begin{cases}1 & |w|\le \pi/2\\ 0 & \pi/2<|w|\le\pi\end{cases}$

Find the overall impulse response $h[n]$of the system. (8)

15. (a) Draw the architecture of any one DSP processor and explain. (16)

Or

(b) Explain the different addressing modes of DSP processor. (16)