LIB
24/5/13 FN

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 21368

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fifth Semester

Electrical and Electronics Engineering

EC 2361/EC 2314/EC 65/10144 EC 502/10133 EE 502 — DIGITAL SIGNAL PROCESSING

(Common to Electronics and Instrumentation Engineering and Instrumentation and Control Engineering)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Given a continuous time signal $x(t) = 2\cos 500\pi t$. What is the Nyquist rate and fundamental frequency of the signal?

2. Determine whether $x[n] = u[n]$ is a power signal or an energy signal.

3. Given a difference equation $y(n) = x[n] + 3x[n-1] + 2y[n-1]$. Determine the system function $H(z)$.

4. Find the stability of the system whose impulse response $h(n) = \left(\frac{1}{2}\right)^n u(n)$.

5. Find the discrete Fourier transform for $\delta[n]$.

6. Draw the basic butterfly diagram for DIF algorithm.

7. Name two methods for digitizing the transfer function of an analog filter.

8. List the properties of chebyshev filter.

9. Mention one important feature of Harvard architecture.

10. What is the advantage of pipelining?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Given $y[n]=x[n^2]$. Determine whether the system is linear, time invariant, memoryless and causal. (8)

(ii) Determine whether the following is an energy signal or power signal. (8)

(1) $x_1[n]=6\cos\left(\frac{\pi}{2}n\right)$

(2) $x_2[n]=3(0.5)^n u[n]$.

Or

(b) Starting from first principles, state and explain sampling theorem both in time domain and in frequency domain. (16)

12. (a) (i) Find the Z-transform and its associated ROC for the following discrete time signal $x[n]=\left(\frac{-1}{5}\right)^n u[n]+5\left(\frac{1}{2}\right)^{-n} u[-n-1]$. (8)

(ii) Evaluate the frequency response of the system described by system function $H(z)=\frac{1}{1-0.5z^{-1}}$. (8)

Or

(b) Using z-transform determine the response $y[n]$ for $n\geq 0$ if $y[n]=\frac{1}{2}y[n-1]+x[n]$, $x[n]=\left(\frac{1}{3}\right)^n u(n) y(-1)=1$. (16)

13. (a) Find the output $y[n]$ of a filter whose impulse response is $h[n]=\{1,1,1\}$ and input signal $x[n]=\{3,-1,0,1,3,2,0,1,2,1\}$ using overlap save method. (16)

Or

(b) Find the DFT of a sequence $x[n]=\{1,2,3,4,4,3,2,1\}$. Using decimation in Time (DIT) algorithm. (16)

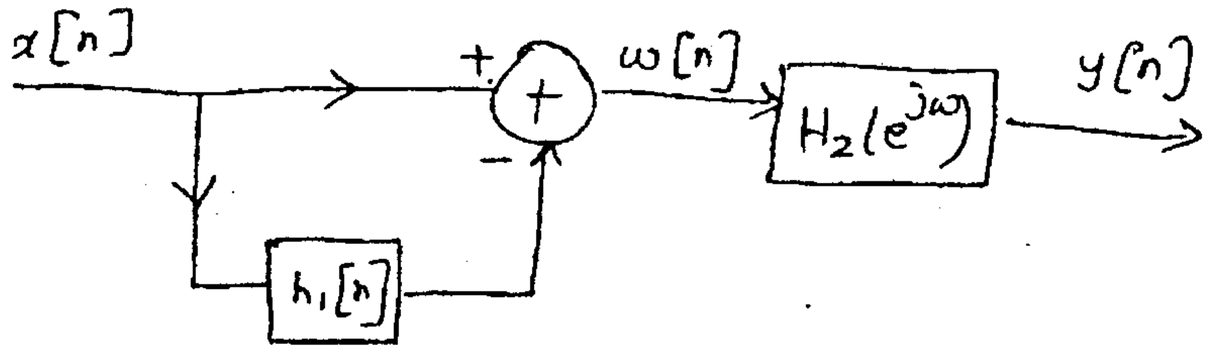
14. (a) Design and realize a digital filter using bilinear transformation for the following specifications. (16)

Monotonic pass band and stop band –3.01 dB cut off at 0.5 π rad magnitude down atleast 15dB at $w=0.75\pi$ rad.

Or

(b) (i) Consider the causal linear shift invariant filter with system function $H(z)=\dfrac{1+0.875z^{-1}}{\left(1+0.2z^{-1}+0.9z^{-2}\right)\left(1-0.7z^{-1}\right)}$. 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 $x[n]=\delta[n]$

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

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

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

15. (a) Explain various addressing modes of a digital signal processor. (16)

Or

(b) Draw the functional block diagram of a digital signal processor and explain. (16)