G 471

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Reg. No.................................

Name.....................................

B.TECH. DEGREE EXAMINATION, MAY 2014

Sixth Semester

Branch : Electrical and Electronics Engineering

DIGITAL SIGNAL PROCESSING (E)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours

Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 4 *marks.*

1. Define a causal system with an example.
2. Determine if the system describe by the following input-output equations are linear or non-linear (i) $y(n) = x^2(n)$; (ii) $y(n) = x(n) + \frac{1}{x(n-1)}$.
3. State and prove any *two* properties of DFT.
4. What are the advantages of FFT over DFT ?
5. Obtain direct from II structure for filter $H(z) = \frac{1 + 0.4z^{-1}}{1 - 0.5z^{-1} + 0.06z^{-2}}$.
6. Explain the shifting properly of z-transform.
7. What is window ? Classify the different types of window functions ?
8. Write a note on multiplexed FIR filter realizations.
9. Obtain the transfer function for a normalized Butterworth filter of order 2.
10. Derive the impulse invariant transformation of transforming analog filter to digital filter.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. A continuous time system is described by the following input output relationship, $y(t) = T\{x(t)\} = [\sin 6t]\, x(t)$. Determine whether this system is

Turn over

(i) Memoryless. (ii) Time invariant.

(iii) Periodic. (iv) Linear.

(v) Causal. (v) Stable.

(6 × 2 = 12 marks)

Or

12. (a) Give the condition of causality of continuous time and discrete time LTI systems in terms of impulse responses.

(4 marks)

(b) Find the impulse response of the system described by the difference equation $y(n) + y(n-1) = x(n) - 2x(n-1)$.

(8 marks)

13. Find the DFT of the sequence $x[n] = [1, 1, 3, 3, 1, 1, 2, 2]$ using radix 2, DIF-FFT algorithm.

Or

14. G (K) and H (K) are 6-point DFTs of sequences $g(n)$ and $h(n)$ respectively. The DFT. G (K) is given as $G(K) = \{1 + j, -2.1 + j3.2, -1.2 - j2.4, 0, 0.9 + j3.1, -0.3 + j1.1\}$. The sequences $g(n)$ and $h(n)$ are related by the circular time shift as $h(n) = g[n-1]6$. Determine H (K), without computing the DFT.

15. Draw the cascade and parallel realizations of the following system function :

$$H(z) = \frac{\left(1+\frac{1}{4}z^{-1}\right)}{\left(1+\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)}.$$

Or

16. A causal LTI system is $H(z) = \dfrac{\left(1-\frac{1}{5}z^{-1}\right)}{\left(1+\frac{1}{4}z^{-1}\right)\left(1-\frac{1}{2}z^{-1}+\frac{1}{3}z^{-2}\right)}$. Obtain the direct form I and direct form II implementation of the system.

17. The desired frequency response of a low pass filter is

$$H_2\left(e^{jw}\right) = H_d\ (w) = \begin{cases} e^{-j3w}, & |w| < 3\pi/4 \\ 0, & \frac{3\pi}{4} < |w| < \pi \end{cases}$$

Determine the frequency response of FIR filter if hamming window is used with N = 7.

Or

18. Design a FIR linear phase filter using Kaiser window to meet the following specifications :

$$0.99 \le \left|H\, e^{(jw)}\right| \le 1.01, \quad 0 \le |\, w \,| \le 0.19\,\pi$$

$$\left|H\left(e^{(jw)}\right)\right| \le 0.01, \quad 0.21\,\pi \le |\, w \,| \le \pi$$

19. Design a digital Chebyshev I filter that satisfies the following constraints

$$0.8 \le |H\ (w)\,| \le 1 \qquad 0 \le w \le 0.2\,\pi$$

$$|H\ (w)| \le 0.2 \qquad 0.6\,\pi \le w \le \pi$$

Use impulse invariant transformation.

Or

20. With neat block diagram, explain the architecture of TMS 320 C5X DSP processor. Explain its key features clearly.

(5 × 12 = 60 marks)