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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Fourth Semester

Electrical and Electronics Engineering

EE 6403 – DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING

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

(Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. State the Parseval's theorem for discrete time signal.
2. What is meant by aliasing effect ?
3. List the methods to find inverse Z transform.
4. Write the conditions to define stability in ROC.
5. Find the DFT of the signal $x(n) = a^n$.
6. Draw the butterfly structure for 2 point DFT using DIT – FFT algorithm.
7. Draw the direct form I structure for 3^{rd} order system.
8. What is prewarping effect ?
9. Write the features of DSP processor.
10. List some example of commercial digital signal processor.

PART – B (5×13=65 Marks)

11. a) i) Determine the power and energy of the given signal. State the signal is power or energy $x(n) = \sin\left(\frac{\pi n}{4}\right)$. (4)

ii) Determine the given signal is periodic or not $x(n) = \cos\left(\frac{2\pi n}{3}\right)$. (3)

iii) Discuss the mathematical representation of signal. Write the difference between continuous and discrete time signal. (6)

(OR)

b) i) Determine whether the system is linear or not $y(n) = ax(n) + bx(n-1)$. (3)

ii) Determine whether the given system is causal or not $y(n) = x(n) + x^2(n-1)$. (4)

iii) Determine whether the system is time invariant and stability : $y(n) = e^{x(n)}$. (6)

12. a) i) State and prove any three properties of Z transform. (8)

ii) Find the Z transform of $x(n) = r^n \cos(n\theta)\, u(n)$. (5)

(OR)

b) i) A discrete system has a unit sample response

$h(n) = \frac{1}{2}\partial(n) + \partial(n-1) + \frac{1}{2}\partial(n-2)$. Find the system frequency response. (7)

ii) Find the convolution of the two sequences $x(n) = \{1, 2, -1, 1\}$ and $h(n) = \{1, 0, 1, 1\}$ using graphical method. (6)

13. a) i) State and prove any two properties of DFT. (6)

ii) Determine the DFT of the following sequence $x(n) = \{5, -1, 1, -1, 2\}$. (7)

(OR)

b) Find the DFT of a sequence $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT – FFT algorithm. (13)

14. a) Obtain an analog Chebyshev filter transfer function that satisfies the given

constraints $\frac{1}{\sqrt{2}} \le |H(j\Omega)| \le 1; \quad 0 \le \Omega \le 2$

$|H(j\Omega)| < 0.1; \quad \Omega \ge 4$. (13)

(OR)

b) Design an ideal lowpass FIR filter with a frequency response.

$$H_d(e^{j\omega}) = 1 \text{ for } -\frac{\pi}{2} \le \omega \le \frac{\pi}{2}$$
$$= 0 \text{ for } \frac{\pi}{2} \le \omega \le \pi$$

Find the values of h(n) for N = 11. Find H(z). Assume rectangular window. (13)

15. a) Draw the architecture of TMS320C50 and explain its functional units. (13)

(OR)

b) Explain the classification of instructions in DSP processor with suitable examples. (13)

PART – C (1×15=15 Marks)

16. a) Design Butterworth filter using the impulse invariance method for the following specifications :

$0.8 \le |H(e^{j\omega})| \le 1 \quad , \quad 0 \le \omega \le 0.2\pi$

$|H(e^{j\omega})| \le 0.2 \quad , \quad 0.6\pi \le \omega \le \pi$

Realize the designed filter using direct form II structure. (15)

(OR)

b) i) How mapping from S-domain to Z-domain is achieved in bilinear transformation. (8)

ii) Apply Bilinear transformation to $H(S) = \frac{2}{(S+1)(S+2)}$. (7)