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OFFICE OF EXAMCELL * CHENNAI 600 130 * ANNA UNIVERSITY OF TECHNOLOGY

Question Paper Code : 20456

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

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. Define spectral density.

2. What is Nyquist rate?

3. Find the stability of the system whose impulse response $h(n) = 2^n u(n)$.

4. What is relation between Z transform and DTFT?

5. Find the DFT sequence of $x(n) = \{1, 1, 0, 0\}$.

6. State and proof the circular frequency shifting property of DFT.

7. Draw the direct form I realization for the given system $y(n) = -0.1\,y(n-1) + 0.2\,y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$.

8. Define warping effect.

9. What are buses used in DSP processor?

10. List the features to select the digital signal processor.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Illustrate the condition of the system to be causal and linearity. Check the same for the given system $y(n) = x(n) + \frac{1}{x(n-1)}$. (7)

(ii) Check the time invariant and stability of the given system $y(n) = \cos x(n)$. (6)

Or

(b) (i) Determine the values of power and energy of the given signal $x(n) = \sin\left(\frac{\pi}{4} - n\right)$. (5)

(ii) Explain the types of signals with its mathematical expression and neat diagram. (8)

12. (a) Find the inverse Z transform of $X(z) = \frac{z^3 + z^2}{(z-1)(z-3)}$ $ROC\ |z| > 3$. (13)

Or

(b) Find the frequency response for the given sequence and plot its magnitude response and phase response $x(n) = \begin{cases} 1 & \text{for } n = -2-1, 0, 1, 2 \\ 0 & \text{otherwise.} \end{cases}$ (13)

13. (a) Determine the DFT of a sequence $x(n) = \{1,1,1,1,1,1,1 0\}$ using DIT algorithm. (13)

Or

(b) Determine the DFT of the given sequence $x(n)$ = {1, 2, 3, 4, 4, 3, 2, 1} using DIF FFT algorithm. (13)

14. (a) Determine the order of the filter using Chebyshev approximation for the given specification α_p = 3 dB, α_s = 16 dB, f_p = 1 KHz and f_s = 2 KHz. Find $H(s)$. (13)

Or

(b) Design an ideal highpass filter using Hanning window with the specification N = 11 of the system $H_d(e^{j\omega}) = 1$ for $\frac{\pi}{4} \le |\omega| \le \pi$; otherwise zero $|\omega| \le \frac{\pi}{4}$. (13)

15. (a) Explain the various types of addressing modes of digital signal processor with suitable example. (13)

Or

(b) Draw the structure of central processing unit and explain each unit with its function. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Design an ideal bandpass filter with a frequency response $H_d(e^{j\omega}) = \begin{cases} 1 & \text{for } \frac{\pi}{4} \le |\omega| \le \frac{3\pi}{4} \\ 0 & \text{otherwise} \end{cases}$ find the values of $h(n)$ for $N = 11$ and plot the frequency response. (15)

Or

(b) Compute the response of the system $y(n) = 0.7y(n-1) - 0.12y(n-2) + x(n-1) + x(n-2)$ to input $x(n) = nu(n)$. Is the system stable? (15)