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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 prove 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 $x(n) = \{1, 1, 1, 1, 1, 1, 0\}$ 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 $\alpha_p = 3$ dB, $\alpha_s = 16$ 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 $\frac{\pi}{4} \leq |\omega| \leq \pi$; otherwise zero $|\omega| \leq \frac{\pi}{4}$. (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

$$H_d(e^{j\omega}) = \begin{cases} 1 & \text{for } \frac{\pi}{4} \leq |\omega| \leq \frac{3\pi}{4} \\ 0 & \text{otherwise} \end{cases}$$

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)

