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ANNA UNIVERSITY :: CHENNAI – 600 025 MODEL QUESTION PAPER

VI - SEMESTER

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

EE337 - DIGITAL SIGNAL PROCESSING

Time: 3hrs **Max Marks: 100**

Answer all Questions

PART – A (10 x 2 = 20 Marks)

1. Define even and odd signals.

2. State the disadvantages of digital signal processing over analog processing.

3. Check whether the following system is time-invariant. $y(n) = n \cdot x^2(n)$

4. State and prove initial value theorem.

5. Define convolution property of continuous time and discrete time signals.

6. What is the method of finding IDFT through DFT?

7. What is aliasing? How it can be eliminated?

8. Define acquisition time and aperture time.

9. Obtain the digital filter transfer function of the following analog filter using impulse invariant transform. $H(s) = 1/(s+1)(s+2)$.

10. What is warping effect?

PART – B (5 x 16 = 80 Marks)

11.i) **Develop the algorithm for radix 2, 8-point decimation in time – FFT method**. (12)

ii) Find **the DFT of the sequence x(n) = { 0, 1, 2, 3 } using DIT - FFT algorithm**. (4)

12.a)i) Find **the inverse Z-Transform** of $X(Z) = (z^2 + z) / (z-1)(z-3)$, ROC $|z| > 3$ by **partial fraction method**. (9)

ii) Determine the **Z transform** of $x(n) = n(-1)^n u(n)$. (7)

OR

12.b)i) State and prove **convolution theorem in Z transform**. (6)

ii) Find the **Z transform and ROC** of the signal $x(n) = -b^n u(-n-1)$ (6)

iii) Find the transfer function of the following LTI system: (4)

$$y(n) = y(n-1) - 0.5\, y(n-2) + x(n) + x(n-1)$$

13.a)i) State and prove **Parseval's theorem in continuous time Fourier Transform**. (8)

ii) Show the relationship between DFT and DTFT. (4)

iii) Find the output of an LTI system whose impulse response is $h(n) = \{1, 1, 1\}$ and input signal is $x(n) = \{3, -1, 0, 1\}$, using **circular convolution**. (4)

OR

13.b)i) Determine the **IDFT of the following sequence using DIF-FFT** method. (10)

$X(k) = \{20, -5.828 + j\,2.414, 0, -0.172 - j\,0.414, 0, -0.172 - j\,0.414, 0, -5.828 + j\,2.414\}$

ii) Prove that all real and even signals will have real and even spectra in DFT. (6)

14.a) Explain in detail the concept of sampling, recovery of signal and discrete time processing of continuous – time signals. (16)

OR

14.b)i) Explain with block diagrams, the functioning of serial – parallel sub-ranging and ripple A/D converters. (10)

ii) Explain any one type of D/A converter with schematic diagram. (6)

15.a)i) Apply **bilinear transform** to the transfer function,

$H(s) = 2/(s+1)(s+3)$ by assuming $T = 0.1s$. (5)

ii) Design a digital **butterworth filter** satisfying the following constraints using bilinear transform. Assume T = 1 sec.

$0.9 \le |H(\omega)| \le 1,\ 0 \le \omega \le \pi/2;$

$|H(\omega)| \le 0.2,\ 3\pi/4 \le \omega \le \pi.$ (11)

OR

15.b)i) Explain briefly the theory of **Chebyshev approximation** of digital filter design(4)

ii) Design a digital **Chebyshev filter** satisfying the following constraints using bilinear transform. Assume T = 1 sec.

$0.707 \le |H(\omega)| \le 1,\ 0 \le \omega \le 0.2\pi;$

$|H(\omega)| \le 0.1,\ 0.5\pi \le \omega \le \pi.$ (12)