

FACULTY OF ENGINEERING

B.E. 3 / 4 (ECE) II - Semester Supplementary Examination, December 2006

Subject : Digital Signal Processing

Time : 3 Hours

Max. Marks : 75

Note : Answer all questions of Part-A and answer any five questions from Part-B.

Part - A (25 Marks)

- 1. State the conditions for a system to be stable and causal.
- 2. Sketch the ROC of the signal.

$$x(n) = 2^n u(n) + 3^n u(-n-1)$$

- 3. Find whether the signal $x(n) = \sin 3n$ is periodic or not. If periodic, find the period.
- 4. The discrete frequency response of a digital filter is periodic. Is it correct. Justify.
- 5. Match the following :

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Time Signal

Its Spectrum

- a) continuous and periodic
- b) discrete and periodic
- c) discrete and aperiodic

- 1) continuous and periodic
- 2) continuous and periodic
- 3) discrete and periodic
- 4) discrete and aperiodic

- 6. Draw the two point Butterfly diagram for the DIF FFT algorithm.
- 7. Why Gibb's oscillations are developed in rectangular window and how they can be reduced.
- 8. Match the following :

Window

Width of transition band

- a) Rectangular
- b) Hamming
- c) Blackman

- 1) $12\pi / N$
- 2) $4\pi / N$
- 3) $8\pi / N$

- 9. IIR filters can have linear phase characteristics. Is it true. Justify.
- 10. Sketch the mapping between S-Plane and Z-Plane under impulse invariant method.

Part - B (50 Marks)

- 11.(a) Discuss the merits and demerits of digital filters over analog filters.
- (b) Check whether the following systems are linear, time invariant and stable.

(i) $y(n)=x(n^2)$ (ii) $y(n) = \sum_{k=n_0}^n x(k)$

..2..

12.(a) Sketch the frequency response of the system

$$y(n) - y(n-1) + 0.24 y(n-2) = 5x(n).$$

(b) Explain the overlap add method to convolve an infinite sequence with a finite sequence.

13.(a) State and prove the symmetry properties of DFT.

(b) Find the DFT of the sequence $x(n)$, where

$$x(n) = \begin{cases} 2^n, & 0 \leq n \leq 3 \\ 1-2^n, & 4 \leq n \leq 7 \\ 0, & \text{otherwise} \end{cases}$$

14.(a) Explain the DIF FFT algorithm with necessary signal flow graphs for an 8-point sequence.

(b) Hence calculate the DFT Coefficients of the sequence

$$x(n) = [2, 3, 4, 5, 4, 3, 2].$$

15.(a) Discuss the finite word length effects.

(b) Design a linear phase FIR filter of length 11 to meet the following characteristics.

Cutoff frequency = 100Hz. Use Hamming Window.
Assume suitable sampling frequency

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16.(a) Compare FIR and IIR filters.

(b) Design a digital low pass filter with 3-dB cutoff frequency at 1KHz and an attenuation of at least 15dB for frequencies larger than 10KHz.

17.(a) Explain the various applications of DSP to speech.

(b) Explain the short time spectrum analysis technique to process the speech signals.

(c) Discuss the merits and demerits of this method.
