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Question Paper Code : 71735

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fifth /Sixth Semester

Electronics and Communication Engineering

EC 6502 — PRINCIPLES OF DIGITAL SIGNAL PROCESSING

(Common to Biomedical Engineering, Medical Electronics)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is the relation between DTFT and DFT?

2. Compute the DFT of the sequence $x(n) = \{1, -1, 1, -1\}$.

3. What are the requirements for the digital filter to be stable and casual?

4. Discuss the need for prewarping.

5. What is Gibbs phenomenon?

6. Compare Hamming window with Blackmann window.

7. What are the methods used to prevent overflow?

8. What is meant by "dead band" of the filter?

9. Define adaptive filtering.

10. List the applications of multirate signal processing.

PART B — (5 × 16 = 80 marks)

11. (a) Compute the DFT for the sequence $\{1, 2, 3, 4, 4, 3, 2, 1\}$. Using radix – 2 DIF – FFT algorithm. (16)

Or

(b) In an LTI system the input $x(n) = \{1, 1, 2, 1\}$ and the impulse response $h(n) = \{1, 2, 3, 4\}$. Perform the circular convolution using DFT and IDFT. (16)

12. (a) Design a digital Butterworth filter with the following specifications

$0.707 \le |H(e^{jw})| \le 1,\ 0 \le \omega \le 0.5\pi$

$|H(e^{jw})| \le 0.2,\ 0.75\pi \le \omega \le \pi$

Determine system function $H(z)$ for a Butterworth filter using Bilinear transformation. (16)

Or

(b) Determine the system function of the lowest order digital Chebyshev filter with the following specifications, 3db ripple in the pass band $0 \le \omega \le 0.2\pi$ and 25db attenuation in the stop band $0.45\ \pi \le \omega \le \pi$. (16)

13. (a) Design a HPF with the following frequency response

$H_d(e^{jw}) = 1$ for $\pi/4 \le |\omega| \le \pi$

$= 0$ for $|\omega| \le \pi/4$

of length $N = 11$ using Hanning window. (16)

Or

(b) Determine the coefficients of a linear phase FIR filter of length N = 15 which has a symmetric unit sample response and a frequency response that satisfies the conditions. (16)

$H(2\pi k/15) = 1$; *for* $k = 0, 1, 2, 3$

$= 0$; *for* $k = 4, 5, 6, 7$

14. (a) Two first order filters are connected in cascaded whose system functions of the individual sections are $H1(z) = 1/(1 - 0.5z^{-1})$ and $H2(z) = 1/(1 - 0.6z^{-1})$. Determine the overall output noise power. (16)

Or

(b) Explain the characteristics of limit cycle oscillations with respect to the system described by the difference equation $y(n) = 0.95y(n-1) + x(n)$. Determine the dead band. (16)

15. (a) Explain the concept of deciation by a factor D and interpolation by factor I. With help of equation explain sampling rate conversion by a rational factor I/D. (16)

Or

(b) Explain the operation of adaptive filter with suitable diagrams and equations. (16)
