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Question Paper Code : 61196

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Fifth Semester

Electronics and Communication Engineering

EC 1302 — DIGITAL SIGNAL PROCESSING

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compute the 4-point DFT of the sequence $x[n] = \{1, 1, 0, 0\}$.

2. Compare DIT-FFT and DIF-FFT algorithms.

3. Mention the characteristics features of rectangular window.

4. Convert the analog filter $H_a(s) = \frac{1}{(s+0.1)^2 + 9}$ into a digital IIR filter by bilinear transformation.

5. What are the two methods of quantization?

6. Define limit cycle oscillations.

7. Find the auto correlation sequence for the power spectral density $P_X(e^{jw}) = 2 + \cos\omega$.

8. Mention the significant of modified periodogram.

9. What are the functions of MAC unit?

10. List out the instruction sets of TMS32OC5X.

PART B — (5 × 16 = 80 marks)

11. (a) Use FFT to perform the linear convolution of the following sequence x[n]={1 , –1, 2, –2, 3, –3, 4, –4} and h[n]={–1, 1} by overlap add method.

Or

(b) (i) Compute circular convolution of the two sequences x[n]={1, 2, 0, 0} and h[n]={2, –2, –1, 1} using DFT-IDFT method. (8)

(ii) Compute the 8 point DFT of the given sequence x[n]={1, 1, 1, 1, 0, 0, 0, 0}. (8)

12. (a) Design a digital Butterworth filter to meet the constraints

$$\frac{1}{\sqrt{2}} \le |H(\omega)| \le 1; \; 0 \le \omega \le 0.2\pi$$

$$0 \le |H(\omega| \le 0.1; \; 0.5\pi \le \omega \le \pi$$

by using bilinear transformation and assume T=1 sec.

Or

(b) (i) Determine the frequency response of FIR filter defined by y[n]=O.25x[n]+x[n-1]+O.25x[n-2]. Calculate the phase delay and group delay. (8)

(ii) The desired frequency response of a filter is

$$H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega}, & -\frac{\pi}{4} \le \omega \le \frac{\pi}{4} \\ 0, & \frac{\pi}{4} \le |\omega| \le \pi \end{cases}$$

Determine the filter coefficients of $h_d[n]$ using Hamming window with N=7. (8)

13. (a) The input to the system y[n]=0.625 y[n-1] + x[n] is applied to an ADC. What is the power produced by the quantization noise at the output of the filter if the input is quantized to (i) 8 bits (ii) 16 bits.

Or

(b) (i) Explain the signal scaling to prevent overflow limit cycle oscillations in the second order digital filter implementation. (8)

(ii) With an example explain fixed and floating representation of binary numbers. (8)

14. (a) Derive the expression to estimate power spectral density using periodogram method and also derive the expression for bias and consistency.

Or

(b) (i) Find the power spectrum for each of the following autocorrelation sequence of a WSS random process. (8)

(1) $r_x(k) = \begin{cases} 10 - |k|, |k| < 10 \\ 0, \textit{Otherwise} \end{cases}$

(2) $r_x(k) = \delta(k-2) + (0.5)^{|k|}$

(ii) Compare the performance of various nonparametric methods of power spectrum estimation. (8)

15. (a) Draw the functional block diagram of TMS32OCSx DSP processor and explain the functions of each block in detail.

Or

(b) (i) Explain how the pipelining is achieved in digital signal processors. (8)

(ii) Discuss the advanced addressing modes of digital signal processors with its functions. (8)
