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Question Paper Code : 41212

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

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. What do you mean by radix-R FFT algorithm, where R is an integer?

2. How many stages of decimations are required in the case of a 64-point radix-2 DIT FFT algorithm?

3. What is the condition for a filter to have linear phase?

4. What are pass and attenuation bands as far as filters are concerned?

5. What is the possible range of numbers in the fixed point-arithmetic?

6. What is meant by quantization of analog signals?

7. Write the expression for the computation of the energy density spectrum.

8. Mention the advantages of the Barlett method of power spectrum estimation.

9. What is pipelining?

10. Mention the arithemetic instructions of C54× processor.

PART B — (5 × 16 = 80 marks)

11. (a) Derive the Radix-2 DIT FFT algorithm with its signal flow diagram. (16)

Or

(b) Write a detailed technical note on the use of FFT algorithms in linear filtering and correlation with an example. (16)

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

(i) Pass-band gain required : -1 dB

(ii) Frequency upto which pass-band gain must remain more or less steady f1 : 200 Hz

(iii) Amount of attenuation required : -40 dB

(iv) Frequency from which the attenuation must start f2 : 600 Hz. (16)

Or

(b) (i) Derive the bilinear transformation and the frequency relationship. (6)

(ii) Design a low-pass FIR filter for the following specifications using Kaiser window. (10)

(1) Frequency of pass-band edge : 2kHz

(2) Gain in pass band : -1 dB

(3) Frequency from which stop-band begins : 3 kHz

(4) Gain in stop-band : -55 dB

(5) Sampling frequency : 12 kHz.

13. (a) (i) Derive the expression for quantization noise power. (6)

(ii) Analyze the limit cycle behavior for the following systems. (10)

$y(n) = 0.7\ y(n-1) + x(n)$

$y(n) = 0.65\ y(n-2) + 0.52y(n-1) + x(n)$

Also determine the dead band of the above systems.

Or

(b) (i) For the system $H(z)=(1+0.75z^{-1})/(1-0.4z^{-1})$, draw the signal flow graph and find scale factor to avoid overflow in the input adder. (8)

(ii) Derive and explain the analytical model of sample and hold operations. (8)

14. (a) (i) Let x1(n) and x2(n) be uncorrelated signals. Show that if x(n) = x1(n) + x2(n) then $\mu x = \mu x1 + \mu x2$ and $\sigma_x^{\ 2} = \sigma_{x1}^{\ 2} + \sigma_{x2}^{\ 2}$. (8)

(ii) Write a detailed technical note on the use of DFT in power spectrum estimation. (8)

Or

(b) (i) The N-Point DFT of a random sequence $x(n)$ is, $X(k) = \sum_{n=0}^{(N-1)} X(n) e^{-j2\pi kn/N}$. Determine the variance and autocorrelation of $X(k)$. (8)

(ii) Explain the Blackman and Tukey method of power spectrum estimation. (8)

15. (a) Describe in detail about the architecture of TMS 320C54x Digital Signal Processor. (16)

Or

(b) (i) State and explain the peripheral function available in the TMS320C54x DSP chip. (8)

(ii) Explain in detail, any six instructions used in TMS320C5X processors. (8)
