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**Question Paper Code: 41461**

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

Sixth Semester

Electronics and Communication Engineering

14UEC601 - DIGITAL SIGNAL PROCESSING

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- How many stages of decimations are required in the case of a 64 point radix 2 DIT FFT algorithm?  
(a) 8                      (b) 6                      (c) 4                      (d) 3
- How many additions are required to compute N point DFT using radix 2 FFT?  
(a)  $\frac{N}{2}\log_2 N$               (b)  $N \log_2 N$               (c)  $\log_2 N$               (d)  $N/2$
- What is the order of the normalized low pass Butterworth filter used to design an analog band pass filter with -3.0103dB upper and lower cut-off frequency of 50Hz and 20KHz and a stop band attenuation 20dB at 20Hz and 45KHz?  
(a) 2                      (b) 3                      (c) 4                      (d) 5
- If  $N_B$  and  $N_C$  are the orders of the Butterworth and Chebyshev filters respectively to meet the same frequency specifications, then which of the following relation is true?  
(a)  $N_C = N_B$               (b)  $N_C < N_B$               (c)  $N_C > N_B$               (d) Cannot be determined

5. Which region of the frequency specification has to be optimized to reduce side lobes of the FIR filter?
  - (a) Stop band
  - (b) Pass band
  - (c) Transition band
  - (d) None of these
6. The values of cutoff frequencies in general depend on
  - (a) Type of the window
  - (b) Length of the window
  - (c) Neither (a) nor (b)
  - (d) Both (a) and (b)
7. Calculate the improvement of signal to quantization noise ratio with an increase of 2 bits to existing bits.
  - (a) 2dB
  - (b) 6dB
  - (c) 4dB
  - (d) 12dB
8. Which of the following is not a quantization error occurring in digital systems?
  - (a) Input quantization error
  - (b) Product quantization error
  - (c) Coefficient quantization error
  - (d) Output quantization error
9. Which of the following is the disadvantage of sampling rate conversion by converting the signal into analog signal?
  - (a) Signal distortion
  - (b) Quantization effects
  - (c) New sampling rate can be arbitrarily selected
  - (d) Both (a) and (b)
10. What value should the bandwidth of  $x(n)$  has to be reduced in order to avoid aliasing?
  - (a)  $F/D$
  - (b)  $F/2D$
  - (c)  $F/4D$
  - (d) none of these

PART - B (5 x 2 = 10 Marks)

11. What are the differences and similarities between DIF and DIT algorithms?
12. What is pre-warping?
13. Write the equation of Hamming and Blackman window functions.
14. Define zero input limit cycle oscillations.
15. Give the steps in multistage sampling rate converter design.

PART - C (5 x 16 = 80 Marks)

16. (a) Compute the eight point DFT of the sequence  $\{1, 1, 1, 1, 0, 0, 0, 0\}$  using DIT and DIF algorithms. (16)

Or

- (b) Compute the linear convolution of finite duration sequences  $h(n)=\{1, 2\}$  and  $x(n)=\{1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1\}$  by overlap add method. (16)
17. (a) Write down steps to design digital filter using bilinear transform technique and using this, design a HPF with a pass band cutoff frequency of 1000Hz and down 10 dB at 350 Hz. The sampling frequency is 5000 Hz. (16)

Or

- (b) Design a digital Butterworth filter using impulse invariance method satisfying the constraints. Assume  $T = 1s$ .

$$\begin{aligned} 0.8 \leq |H(w)| \leq 1; \quad 0 \leq w \leq 0.2\pi \\ |H(w)| \leq 0.2; \quad 0.6 \pi \leq w \leq \pi \end{aligned} \quad (16)$$

18. (a) Design a filter using a Hamming window with  $N=7$  with

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & -\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < |\omega| \leq \pi \end{cases} \quad (16)$$

Or

- (b) Using a rectangular window technique, design a low pass filter with a pass band gain of unity, cut-off frequency of 1000 Hz and working at a sampling frequency of 5 KHz. The length of the impulse response should be 7. (16)
19. (a) Explain the characteristics of limit cycle oscillation with respect to the system described by the difference equation  $y(n)=0.95y(n-1)+x(n)$ . Determine the dead band of the filter. (16)

Or

(b) (i) What is quantization of analog signals? Derive the expression for the quantization error. (8)

(ii) Summarize the addressing modes of Digital Signal Processor TMS320C5X. (8)

20. (a) Implement a two stage decimator for the following specifications:

Sampling rate of the input signal  $10\text{ kHz}$ ,  $M=100$ , Pass band=  $0$  to  $50\text{ Hz}$ , Pass band ripple =  $0.1$  and Stop band ripple =  $0.001$ . (16)

Or

(b) (i) Explain the multistage implementation of sampling rate conversion with a block diagram. (8)

(ii) A signal  $x(n)$  is given by  $x(n) = \{0, 1, 2, 3, 4, 5, 6, 0, 1, 2, 3, \dots\}$ . Obtain the decimated signal with a factor of 2 and the interpolated signal with a factor of 2. (8)

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