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Question Paper Code : 80343

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth Semester

Medical Electronics

EC 6502 — PRINCIPLES OF DIGITAL SIGNAL PROCESSING

(Common to Electronics and Communication Engineering and Sixth Semester Biomedical Engineering)

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compare Radix 2 DIT, DIF FFT algorithm.

2. Test the causality and stability of $y(n) = \sin x(n)$.

3. What is known as prewarping?

4. What are the properties of bilinear transformation?

5. What do you understand by linear phase response?

6. What are the desirable characteristics of the window?

7. What are the different types of fixed point representation?

8. Name the three quantization error due to finite word length registers in digital filters.

9. What is the need for anti imaging filter after upsampling signal?

10. What is meant by adaptive filter?

PART B — (5 × 16 = 80 marks)

11. (a) Derive radix 2 – DIT FFT algorithm and obtain DFT of the sequence $x(n) = \{1,2,3,4,4,3,2,1\}$ using DIT algorithm. (16)

Or

(b) (i) Compute IDFT of the sequence $X(K) = \{7, -0.707, -j0.707, -j, 0.707 - j0.707, 1, 0.707 + j0.707\ j, -0.707 + j\ 0.707\}$ using DIF algorithm. (10)

(ii) Perform the linear convolution of finite duration sequences $h(n) = \{1,2\}$ and $x(n) = \{1,2,-1,2,3,-2,-3,-1,1,2,-1\}$ by overlap save method. (6)

12. (a) Design a third order Butterworth digital filter using impulse invariant technique. Assume sampling period T = 1 sec. (16)

Or

(b) Convert the single pole low pass filter with system function $H(z) = \frac{0.5(1+z^{-1})}{1-0.302z^{-2}}$ into band pass filter with upper and lower cut off frequencies w_u & w_L respectively. The LPF has 3dB BW of $w_p = \frac{\pi}{6}$ & $w_u = \frac{3\pi}{4}$, $w_l = \frac{\pi}{4}$.

13. (a) Design an ideal BPF with a frequency response

$$H\alpha(e^{jw}) = \begin{cases} 1, & for\ \frac{\pi}{4} \le |w| \le \frac{3\pi}{4}. \\ 0, & \text{otherwise} \end{cases}$$

Find the value of $h(n)$ for $N = 11$ and plot the frequency response. (16)

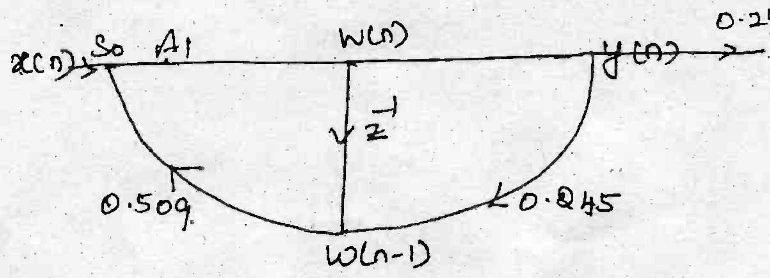
Or

(b) Design a linear phase FIR filter with a cut off frequency of $\frac{\pi}{2} r/\sec$. Take $N = 17$ using frequency sampling techniques. (16)

14. (a) Study the limit cycle behaviour of the system described by $y(n) = Q[a\,y(n-1)] + x(n)$, where $y(n)$ is the output of the filter and $Q[.]$ is quantization. Assume $a = \frac{7}{8}$, $x(0) = \frac{3}{4}$ & $x = 0$, for $n > 0$ choose 4 bit sign magnitude. (16)

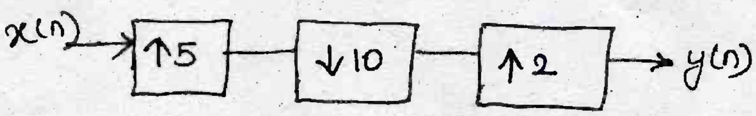
Or

(b) For the digital network shown in figure find $H(z)$ and scale factor. So to avoid over flow register A_1 (16)



15. (a) (i) Explain in about detail the multistage implementation of sampling rate conversion. (8)

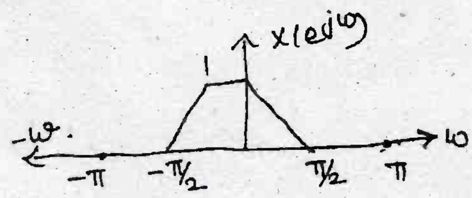
(ii) For the multirate system shown in figure develop an expression for the output $y(n)$ as a function of i/p $x(n)$ (8)



Or

(b) (i) Show that the upsampler and down sampler are time variant systems. (8)

(ii) The frequency response of $x(n)$ is shown in figure



If the input is passed through a down sampler by 2, find the frequency response of output and give your comment on aliasing. (8)