Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 91452

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Fifth/Sixth Semester
Electronics and Communication Engineering
EC 6502 – PRINCIPLES OF DIGITAL SIGNAL PROCESSING
(Common to Biomedical Engineering, Medical Electronics)
(Regulations 2013)
(Also Common to PTEC6502 – Principles of Digital Signal Processing for B.E. Part Time – Fourth Semester Electronics and Communication Engineering Regulations 2014)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. Whether the system with impulse response, $h(n) = -\frac{1}{4}\delta(n+1) + \frac{1}{2}\delta(n) - \frac{1}{4}\delta(n-1)$ is stable and causal ? Justify.
2. Determine the number of complex additions and complex multiplications required to compute a 64-point DFT using radix-2 FFT algorithm.
3. List the properties of Butterworth filter.
4. Determine the order of Chebyshev digital filter that meets the following specifications :
   1 dB ripple in the pass band $0 \le |\omega| \le 0.3\pi$ and
   At least 60 dB attenuation in the stop band $0.35\pi \le |\omega| \le \pi$. Use the bilinear transformation.
5. Mention the advantage of linear phase realization over direct form realization.
6. List the desirable window characteristics.
7. What are the different types of fixed point number representation ?
8. Name the three quantization error due to finite word length registers in digital filters.
9. What is concept of adaptive filtering ?
10. List the applications of multirate signal processing.

PART – B **(5×13=65 Marks)**

11. a) Compute the 8-point IDFT to obtain the sequence x(n), given the DFT coefficients X(k) = {2, 0.5 – j 1.206, 0, 0.5 – j 0.206, 0}. **(13)**

(OR)

b) i) Check whether the following system is linear, causal and stable

$$y(n) = \frac{1}{N}\sum_{M=0}^{N-1} x(n-m)\cdot$$ **(6)**

ii) Find the impulse response of the causal system y(n) – y(n – 1) = x(n) + x(n – 1). **(7)**

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

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

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

Determine system function H(z) for a Butterworth filter using Bilinear transformation. **(13)**

(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 25 db attenuation in the stop band $0.45\pi \le \omega \le \pi$. **(13)**

13. a) Design a digital low pass FIR filter of length 11 with cutoff frequency = 1000 Hz. The filter should operate at the rate of 8000 samples/sec. Design using rectangular window. **(13)**

(OR)

b) Using frequency sampling technique, design a 11 – tap linear phase FIR LPF with cutoff frequency 1 KHz. The sampling rate F_s = 8KHz. **(13)**

14. a) Draw the quantization noise model for a second order system

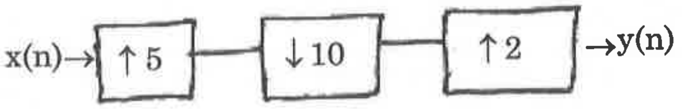
$$H(z) = \frac{1}{1 - 2r\cos\theta 2^{-1} + r^2 z^{-2}}$$ and find the steady state output noise variance. **(13)**

(OR)

b) Explain the characteristics of limit cycle oscillation with respect to the system described by the difference equation y(n) = 0.95 y(n – 1) + x(n). Determine the dead band of the filter. Take $x(n) = \begin{cases} 0.75 & ; \quad n = 0 \\ 0 & ; \quad n \neq 0 \end{cases}$ and let the number of bits, b = 4 (excluding the sign bit). **(13)**

15. a) i) Explain in detail about the multistage implementation of sampling rate conversion. **(5)**

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) With a neat block diagram, briefly explain on how an adaptive filter is used to perform channel equalization. **(13)**

PART – C **(1×15=15 Marks)**

16. a) i) The frequency response of x(n) is shown in figure 1.

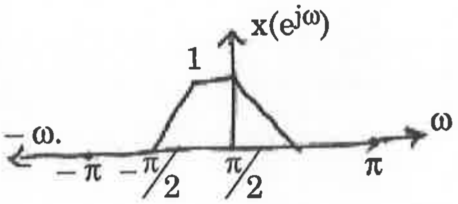


Figure 1

If the input is passed through a down sampler with a decimation factor of 2, find the frequency response of output and give your comment on aliasing. **(6)**

ii) Derive the expression for illustrating the frequency domain characteristics of a decimator with a factor of D. **(9)**

(OR)

b) Using FFT principles, compute the response of the system with impulse response h(n) = {1, 1} for the input x(n) = {3, 1, 3}. **(15)**