Reg. No. :

Question Paper Code : 52917

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth/Sixth Semester

Electronics and Communication Engineering

EC 6502 – PRINCIPLES OF DIGITAL SIGNAL PROCESSING

(Common to B.E. Biomedical Engineering/Medical Electronics)

(Regulation 2013)

(Also Common to PTEC 6502 – 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. Find the DFT of the sequence $x(n) = \{1, 1, 0, 0\}$.

2. Write the DFT and inverse DFT (IDFT) for an N-point sequence $\{x(n)\}$.

3. State the use of z transforms in IIR filter design.

4. Draw a realization structure of second order digital filter.

5. If $H(z)$ has zeros at $z_1 = \frac{1}{\sqrt{2}} + \frac{j}{\sqrt{2}}$, $z_2 = 2$. Determine the lowest degree $H(z)$ that has a linear phase.

6. Draw the frequency response of N point rectangular window.

7. Draw the quantization noise model for a I order system.

8. Why rounding is preferred to truncation in realizing digital filter?

9. Mention the applications of Multirate signal processing.

10. The magnitude response of an input signal is shown in Fig. 10. if the input sequence is passed through an upsampler of factor 4, plot the magnitude response of output signal.

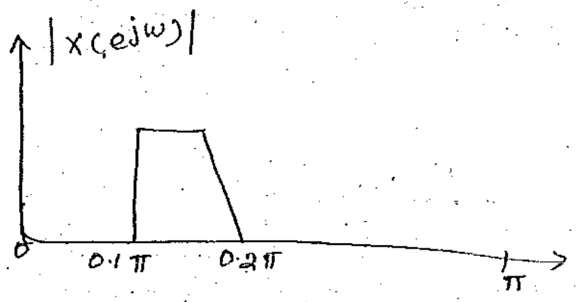

Fig. 10

PART B — (5 × 13 = 65 marks)

11. (a) (i) Mention the properties of DFT. (5)

(ii) Find the circular convolution of the two sequences $x_1(n) = \{1, 2, 2, 1\}$ and $x_2(n) = \{1, 2, 3, 1\}$ using concentric circle method or matrix method. (8)

Or

(b) Find the 8 point DFT of the given sequence $x(n) = \{0, 1, 2, 3, 4, 5, 6, 7\}$ using DIF, radix 2 FFT algorithm. (13)

12. (a) Explain IIR filter design using Impulse Invariance techniques.

Or

(b) Explain IIR Filter Design by Approximation of Derivatives.

13. (a) (i) Write the expression for the frequency response of Hanning window. (3)

(ii) Design an ideal high pass filter with a frequency response

$$H_d(e^{jw}) = 1 \text{ for } \frac{\pi}{4} \le |w| \le \pi$$

$$= 0 \text{ for } |w| \le \frac{\pi}{4}$$

Find the values of $h(n)$ for $N = 11$. Find $H(z)$. Plot the magnitude response. (10)

Or

(b) (i) Briefly explain about finite word length effect in FIR digital filters. (3)

(ii) Determine the filter coefficients $h(n)$ obtained by sampling

$$H_d(e^{jw}) = e^{-j(N-1)w/2} \quad 0 \le |w| \le \frac{\pi}{2}$$

$$= 0 \quad \frac{\pi}{2} \le |w| \le \pi$$

for $N = 7$ (10)

14. (a) With necessary diagrams explain product quantization error.

Or

(b) Write short notes on the following :

(i) Overflow limit cycle oscillations. (5)

(ii) Signal scaling. (8)

15. (a) (i) Briefly explain about Cascading Sample Rate Converters. (8)

(ii) For the Multirate system shown in Fig. 15(a)(ii). Develop an expression for the output $y(n)$ as a function of the input $x(n)$. (5)

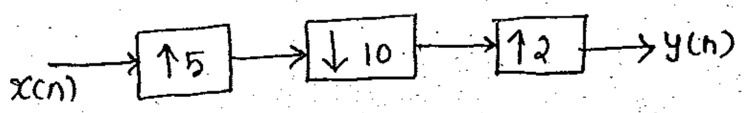

Fig. 15(a)(ii)

Or

(b) Explain sampling rate conversion by a rational factor I/D.

PART C — (1 × 15 = 15 marks)

16. (a) With necessary expressions explain linear phase FIR filter.

Or

(b) For the given transfer function $H(z) = H_1(z)H_2(z)$, where $H_1(z) = \frac{1}{1-0.5z^{-1}}$ and $H_2(z) = \frac{1}{1-0.4z^{-1}}$, find the output round off noise power. Calculate the value if $b = 3$ (excluding sign bit).