Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 52447

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Fifth Semester
Electronics and Communication Engineering
EC2302 – DIGITAL SIGNAL PROCESSING
(Regulations 2008)
(Common to PTEC2302 – Digital Signal Processing for BE (Part – Time)
Fourth Semester – ECE – Regulations 2009)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. Determine the X(0) value from given x(n) = {1, 0, 1, 0, 1, 0, 1, 0}.
2. Compute additions and multiplications required for 8 Point DFT by FFT algorithm.
3. State why impulse invariant transformation is not suitable for the design of High pass filter.
4. Define warping effect. State how it can be compensated.
5. State the condition for linear phase in FIR filter.
6. Write the equation of Hamming and Hanning window function.
7. What is the equivalent decimal number of the binary number b = 0.1101 after truncated by 2 bits.
8. Define deadband. How do calculate the deadband of an IIR system ?
9. State why low pass filter is used before downsampling in decimation and after upsampling in interpolation process.
10. Mention any two applications of multirate signal processing.

PART – B (5×16=80 Marks)

11. a) i) Compute eight point DFT of $x(n) = \{0.5\ 0\ 0.5\ 0\ 0.5\ 0\ 0.5\ 0\}$ using DIT – FFT method. (8)

ii) Find the IDFT of $X(k) = \{6 - 2 - 2j\ 2 - 2 + 2j\}$ using DIT and DIF algorithm. (8)

(OR)

b) Perform linear convolution of $x(n) = \{1, -1, 2, -2, 3, -3, 4, -4, 5, -5\}$ and $h(n) = \{3, 2\}$ using overlap add and overlap save method. (16)

12. a) Design a Butterworth digital lowpass filter using impulse invariant technique with T = 1 sec satisfying the following specification (16)

$$0.9 \le \left|H(e^{j\omega})\right| \le 1 \quad 0 \le \omega \le 0.3\pi$$

$$\left|H(e^{j\omega})\right| \le 0.1 \quad 0.6\pi \le \omega \le \pi$$

(OR)

b) Design a Chebyshev digital lowpass filter using Bilinear transformation technique with T = 1 sec satisfying the following specification (16)

$$0.8 \le \left|H(e^{j\omega})\right| \le 1 \quad 0 \le \omega \le 0.2\pi$$

$$\left|H(e^{j\omega})\right| \le 0.2 \quad 0.6\pi \le \omega \le \pi$$

13. a) Design an ideal lowpass filter with frequency response using hamming window. Assume order of the filter N = 11. (16)

(OR)

b) Design an ideal bandpass filter using Frequency sampling technique and rectangular window. Assume order of the filter N = 7. (16)

14. a) i) Define Quantization noise. Derive the quantization noise power. (8)

ii) Analyze the quantization effect of given second order IIR filter system function on both direct and cascade form. Assume b = 3 bits. (8)

$$H(z) = \frac{1}{(1 - 0.95z^{-1} + 0.225z^{-2})}$$

(OR)

b) Explain the characteristics of a limit cycle oscillations with respect to the systems described by the difference equation for b = 3 bits. **(16)**

i) $y(n) = 0.9y(n-1) + x(n)$

ii) $y(n) - 0.75y(n-1) = x(n)$

15. a) Discuss the spectrum of input signal and decimated signal in decimation process. Also explain how sampling rate can be increased by interpolation operation with proper spectrum. **(16)**

(OR)

b) i) Implement multistage sampling rate conversion of $(L/D) = \frac{8}{27}$ and $\frac{39}{24}$ **(8)**

ii) Discuss about narrow band filters. **(8)**