Reg. No. :

Question Paper Code : 42450

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fifth Semester

Electronics and Communication Engineering

EC 2302 – DIGITAL SIGNAL PROCESSING

(Regulations 2008)

(Common to PTEC 2302 – Digital Signal Processing for B.E. (Part-Time)

Fourth Semester – Electronics and Communication Engineering – Regulations 2009)

Time : Three Hours Maximum : 100 Marks

Codes /Tables/Charts to be permitted, if any, may be indicated.

Answer ALL questions

PART – A (10×2=20 Marks)

1. State the periodicity property of DFT.
2. What is twiddle factor ?
3. Compare IIR and FIR filters.
4. State the significance of Impulse Invariant Method.
5. List any two advantages of FIR filter.
6. Write the frequency response equation of hanning window.
7. Distinguish between fixed point and floating point arithmetic.
8. List any two finite word length effect in digital filters.
9. Differentiate between Decimation and Interpolation.
10. What is polyphase decomposition ?

PART – B (5×16=80 Marks)

11. a) Compare linear convolution of the following two sequences using DFT. x(n) = {1, 2} and h(n) = {2, 1}.

(OR)

b) Compute 8-point DFT of the discrete time signal, x(n) = {2, 1, 2, 1, 1, 2, 1, 2} using Radix-2 DIT FFT.

12. a) Design a butterworth digital IIR lowpass filter using bilinear transformation by taking T = 0.5s, to satisfy the following specifications.

$$0.707 \le \left|H\left(e^{j\omega}\right)\right| \le 1.0 \ ; \quad \text{for } 0 \le \omega \le 0.45\pi$$

$$\left|H\left(e^{j\omega}\right)\right| \le 0.2 \ ; \quad \text{for } 0.65\pi \le \omega \le \pi$$

Draw direct form-I structure of the filter.

(OR)

b) Obtain the cascade form realization of the LTI system governed by the equation

$$y(n) = -\frac{3}{8}y(n-1) + \frac{3}{32}y(n-2) + \frac{1}{64}y(n-3) + x(n) + 3x(n-1) + 2x(n-2)$$

13. a) Design a linear phase FIR high pass filter using hamming window, with a cutoff frequency, $\omega_c = 0.8\,\pi$ rad/sample and N = 7.

(OR)

b) i) Explain the procedure for designing a FIR filter by Frequency Sampling technique. **(6)**

ii) Describe about linear phase realization of FIR filters. **(10)**

14. a) Find the quantization step size, variance of the error signal and variance of the quantization noise at the output for the given LTI system. The input signal x(n) has a range of – 5V to + 5V, represented by 8-bits.
$y(n) = 0.68y(n-1) + 0.15x(n)$.

(OR)

b) For second-order IIR Filter, $H(z) = \frac{1}{\left(1-0.5z^{-1}\right)\left(1-0.45z^{-1}\right)}$. Analyze the effect of shift in pole location with 3-bit co-efficient representation in the direct and cascade form.

15. a) i) List the applications and advantages of multirate DSP. **(6)**

ii) Explain the concept of sampling rate conversion and its multistage implementation. **(10)**

(OR)

b) Determine the upsampled version of the signal x(n) = {1, –1, 2, – 2}, by taking I = 2, 3 as the sampling rate multiplication factor.