B.E./B.TECH. Degree Examination, December 2020

Fifth Semester

EC16651 Digital Signal Processing

(Regulation 2016)

Time: Three hours Maximum :80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. If a signal has a maximum frequency of 2KHz, what should be the sampling frequency so that there is no aliasing?

   a. 1KHz b. 2KHz c. 3KHz d. 4KHz

2. What is the circular convolution of the sequences x1(n)={2,1,2,1} and x2(n)={1,2,3,4}?
   a. {14,14,16,16}
   b. {16,16,14,14}
   c. {2,3,6,4}
   d. {14,16,14,16}
3. Consider the assertions given below. Which among them is an advantage of FIR filter?
   a. Necessity of computational techniques for filter implementation
   b. Requirement of large storage
   c. Incapability of simulating prototype analog filter
   d. Presence of linear phase response
4. The phase factors are multiplied before the add and subtract operations in
   a. DIT radix-2 FFT
   b. DIF radix-2 FFT
   c. Inverse DFT
   d. both a and c
5. Find the z-transform of {0.5,1,3,5,-1,4}
6. Realize y(n) + y(n-1) + 0.25y(n-2) = x(n)+2x(n-1) in direct form-II
7. Express the fraction 7/8 and -7/8 in sign magnitude, 2's complement and 1's complement.
8. Determine the dead band of the filter with pole at 0.5 and the number of bits used for quantization is 4(including sign bit)

PART B - (4 X16 = 64 marks)

09. (a) (i) The input x[n] and the output y[n] of a system is related by the difference equation $y[n]=x[n-1]+x[1-n]$ **(8)**

Test the system for linearity, causality, time variance and stability.

(ii) Compute the z-transform of the discrete-time signal **(8)**

$x[n]=4^n(u[n+3]-u[n-4]+u[-n-1])$ and find its ROC.

(OR)

(b) (i) Using Overlap-save method, find the response of a system whose input and impulse response are as follows. **(8)**

x[n] = {1, -1, 2, 1, 2, -1, 1, 3, 1} and h[n] = {1, 2, 1}

(ii) Determine the transfer function and impulse response of an LTI discrete time system described by the following difference equation, **(8)**

y[n]+3y[n-1]+2y[n-2)= x[n]+ x[n-1]

10. (a) Find the DFT of the sequence **(16)**

x[n] = {1, 2, 3, 4, 4, 3, 2, 1} using DIF-FFT algorithm.

(OR)

(b) Find 8-point DFT of x(n) = {1,1,1,1,1,1,1,1} using its analysis equation. **(16)**

11. (a) Design a Butterworth digital IIR LPF using impulse invariant transformation by taking T=1s satisfying the following specifications, **(16)**

$$0.707 \le |H(e^{j\omega})| \le 1, \quad 0 \le \omega \le 0.3\pi$$

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

(OR)

(b) Design a digital Chebyshev LPF filter to satisfy the constraint **(16)**

$$0.707 \le |H(e^{j\omega})| \le 1, \quad 0 \le \Omega \le 0.2\pi$$

$$|H(e^{j\omega})| \le 0.1, \quad 0.5\pi \le \Omega \le \pi$$

Using bilinear transformation and assuming T = 1s.

12. (a) Design a LPF with M =9 using Hamming window **(16)**

$$H_d(\omega) = \begin{cases} 1 & \omega \le \pi/4 \\ 0 & \pi/4 \le \omega \le \pi \end{cases}$$

(OR)

(b) Consider the transfer function $H(z)=H_1(z)H_2(z)$ where **(16)**

$H_1(z)=1/(1-a_1z^{-1})$, $H_2(z)=1/(1-a_2z^{-2})$.

Find the output round off noise power. Assume $a_1=0.5$ and $a_2=0.6$ and find out the output round off noise power.