Roll No.

[Total No. of Pages : 3]

5E1394

# B.Tech V- Semester (Main ) Examination Nov. - 2019
## PCC/PEC Electronics And Comm.Engg.
## 5EC 4-04 Digital Signal Processing

5E1394

Time : 3 Hours

Maximum Marks : 120

Min. Passing Marks : 42

*Instructions to Candidates:*

*Attempt all ten questions from Part A, five questions out of seven from Part B and four questions out of five from Part C.*

*(Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly).*

## PART - A

**(Answer should be given up to 25 words only)**

**All questions are compulsory** **(10×2=20)**



1. Find z-transform of $x[n] = 2^n . u(n-2)$ [2]
2. Explain the shift property of z-transform. [2]
3. Why linear convolution is important in digital signal processing? [2]
4. If DFT of $x[n]$ is $X(k)$, then find DFT of $\{x(n+m)_N\}$ [2]
5. Write symmetry property and Periodicity property of the phase factor $W_N$ [2]
6. Draw Direct form-II realization for the following system $H(z) = \frac{1-2z^{-1}}{1+5z^{-1}}$ [2]
7. For the FIR digital filter $H(e^{jw}) = (0.7 + 0.6\cos w - 0.9\cos 2w)e^{-j7w}$. Determine the phase and group delay. [2]
8. Write advantages of the FIR filters? [2]
9. Write Analog frequency transformation relation for low pass to low pass and low pass to high pass transformation [2]
10. Explain sign-magnitude format of fixed point representation. [2]

## PART - B

### (Analytical/Problem solving questions)

(5×8=40)

**Attempt any Five questions**

1. Obtain the cascade realisation of the system characterized by the transfer function. [8]

$$H(z)=\frac{2(z+2)}{z(z-1)(z+5)(z+4)}$$

2. Find the 4-point DFT of the sequence $x(n)=\cos\frac{n\pi}{4}$ [8]

3. Given $x(n)=\{0,1,2,3\}$, find $X(k)$. Using DIT FFT algorithm. [8]

4. The output $y(n)$ for an LTI system to the input $x(n)$ is $y(n)=x(n)-2x(n-1)+x(n-2)$ compute and sketch the magnitude response of system for $0\le w\le 2\pi$ [8]

5. Calculate the order of the Butter warm digital filter for the following specifications: (Use bilinear transformation)

   Pass band frequency $w_p=0.2\pi$

   Stop band frequency $w_s=0.3\pi$

   Pass band ripple $S_p=0.89$

   Stop band ripple $S_s=0.18$

   Also calculate the 3dB cut-off frequency of the above designed filter. [8]

6. Discuss briefly multi-rate signal processing by Decimator and interpolator. [8]

7. Discuss Rounding off and Truncation errors in sign magnitude representation. [8]

## Part - C

### (Descriptive/Analytical/Problem Solving/Design questions)

**Attempt any four questions** (4×15=60)

1. Design a FIR filter with using Hamming window with M = 7

$$H_d(e^{-jw})=\begin{cases}e^{-j3w}, & -\frac{\pi}{4}\le w\le \pi/4\\ 0, & \frac{\pi}{4}\le |w|\le \pi\end{cases}$$

[15]

2. Given $x(n) = n + 1$ and $N = 8$, find $X(k)$ using DIF FFT algorithm [15]

3. Discuss the application of DSP in the speech analysis and speech synthesis systems. Draw the suitable representation diagrams also to explain the processes. [15]

4. Prove the following properties with suitable mathematical expressions

   a) Differentiation property in z-transform

   b) Circular frequency shift DFT

   c) Parseval's theorem in DFT to represent the energy in the finite duration sequence $x(n)$ [15]

5. Calculate circular periodic convolution of the following two sequences by using DFT and IDFT Property. [15]