

M.Tech. Electronics & Communication Engineering (CBCS Pattern) Semester-I  
**PECS13 - Advanced Digital Signal Processing**

P. Pages : 1

Time : Three Hours



**GUG/S/25/10980**

Max. Marks : 70

- Notes :
1. All questions carry equal marks.
  2. Attempt **any five** questions.
  3. Assume suitable data wherever necessary.
  4. Illustrate your answers wherever necessary with the help of neat sketches.

1. A) Compare the Z-transform and the Discrete-Time Fourier Transform (DTFT) in terms of their applicability, especially regarding stability and convergence. 7  
B) State and prove any two properties of DFT. 7
2. A) Find the inverse Z - transform for  $x(n) = \frac{1}{(1-0.8z^{-1})(1-0.3z^{-1})}$  7  
B) List the three well known methods of designing techniques for FIR filter and explain any one. 7
3. A) Compare the complex multiplication and addition in between DFT and FFT. 7  
B) Perform the circular convolution of the following sequences using DFT and IDFT.  
 $X_1(n) = \{1, 2, 1, 3\}$  and  $x_2(n) = \{1, 1, 1, 1\}$  7
4. A) Compute 8 point DFT of the sequence  $x(n) = \{1, 2, 1, 2, 2, 4, 6, 8\}$  using Radix-2 DIT FFT algorithm. 7  
B) Explain method of constructing Butterworth circle in the z - plane using the bilinear transformation method. 7
5. A) Design a linear phase FIR band pass filter to pass frequencies in the rang  $0.4$  to  $0.65\pi$  rad / sample by taking 9 samples of hamming window. 8  
B) Discuss about multirate signal processing. 6
6. A) Explain how the parametric methods overcome the limitations of the nonparametric methods. 7  
B) Explain LMS algorithm with neat diagram and relevant equations. 7
7. A) What is multi rate signal processing? Discuss about the sampling rate conversion by factor of I/D. 7  
B) For an AR (I) model defined by  $x[n] = \phi_1 x[n-1] + w[n]$  where  $w[n]w[n]w[n]$  is white noise, derive the expression for the autocorrelation function. 7
8. A) Explain in detail uniform DFT filter bank. 7  
B) Describe the mathematical formulation of a lattice filter. How is the output of a lattice structure computed? 7

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