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| **UNIT-I** | |
| **1(a)** | Consider a rectangular pulse defined as    Find DTFT to the given x[n] and draw its spectrum |
| **(b)** | The first five points of the 8-point DFT of a real-valued sequence are given by Find the remaining 3 points. |
| **2** | Find the DFT of a sequence for N=8 and Draw its spectrum |
| **3(a)** | What are the properties of twiddle factor |
| **(b)** | What are the steps involved in the computation of IDFT through FFT |
| **4** | Find the circular convolution of the two sequences x1[n]={1,2,3,2,1} x2[n]={1,2,3} using  a) Concentric circles method b) Matrix multiplication method |
| **5** | Make use of the properties of the Discrete Fourier Series Solve the following for periodic Sequences.   1. Time Shifting Property 2. Time Reversal Property 3. Parsevals Relation |
| **6** | Make use of the properties of the Discrete Time Fourier Transform Solve the following for Aperiodic Sequences.   1. Frequency Shifting Property 2. Differentiation in Frequency Domain Property 3. Conjugation Symmetry Property |
| **7** | Make use of the properties the Discrete Fourier Transform  Solve the following   1. Periodicity Property 2. Circular shift of a sequence 3. Convolution Property |
| **8** | Solve the circular convolution of the following sequences  x[n]={1,1,2,1} h[n]={1,2,3,4} using DFT and IDFT method |
| **9** | Examine the 8-pt DFT of the sequence x[n] = {2,2,2,2,1,1,1,1} using Radix-2 DIF-FFT Algorithm and draw its spectrum. |
| **10** | Examine the 8-pt DFT of the sequence x[n] = {2,2,2,2,1,1,1,1} using Radix-2 DIT-FFT Algorithm and draw its spectrum. |
| **11** | Given the 8-point DFT of the sequence x[n] = {1,1,1,1,0,0,0,0}. Examine the DFT of x1[n]={1,0,0,0,0,1,1,1} and x2[n]={0,0,1,1,1,1,0,0} |
| **12** | In an DT LTI system the input x[n] = {1,1,1} and the impulse response h[n]={-1,-1}. Examine its response using Radix 2 DIT FFT algorithm |
| **13** | Examine the response of DT LTI system when input and impulse response is given by x[n]={1,1,1,1} and h[n]= {1,1} using (i) circular convolution (ii) DFT |

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| **UNIT-II** | |
| **1** | Summarize the following properties of Z-Transforms.  i) Linearity ii) Frequency Shifting iii) Convolution iv) Parseval’s Relation |
| **2** | Explain the properties of Region of Convergence in Z-Transforms |
| **3** | Show the following properties of the Z-Transforms  Sequence Z-Transform  (i) x[n-m] z−m X[z]  (ii) x\*[n] X\*[z\*]  (iii) anx[n] X[a-1z]  (iv) x[-n] X[z-1]  (v) n x[n] -z X[z] |
| **4** | State and Show Initial Value theorem and Final Value theorem for Z-Transforms. |
| **5** | Make use of Z-Transforms find the Impulse and Step response of the given system |
| **6** | Make use of Z-Transforms indicate its ROC for the given sequence and sketch its ROC. |
| **7** | Make use of Z-Transforms find the response of an LTI system whose input and impulse response is given by and for i) a≠b and ii) a=b |
| **8** | Solve the difference equation to get the system function and obtain step response |
| **9** | Build the canonical form of realization for the system given below |
| **10** | Build the direct form I and direct form II for the system described by |
| **11** | Build the following system using min. no of multipliers |
| **12** | A system is represented by its difference equation  *𝑦* find out its system function and Examine its stability and causality for all possible ROCs |
| **13** | Determine the Z-Transform for the following sequences i)  ii) x[n]=u[n]-u[n-5] |
| **14** | Examine the Inverse Z-Transform of the following for all possible ROCs |
| **15** | a) Examine the impulse response of the system described by the second order difference equation  b) Examine the response of above system for the input |

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| **UNIT-III** | |
| **1(a)** | Compare Analog and Digital filters. |
| **(b)** | Summarize the advantages and disadvantages of Digital filters over Analog filters |
| **2** | Explain Butterworth filter approximation and show that pole location lies on a circle. |
| **3** | Find the order and poles of Butterworth low pass filter that has a 3dB attenuation at 500Hz and an attenuation of 40dB at 1KHz. |
| **4** | Explain Chebyshev filter approximation and show that pole location lies on a ellipse. |
| **5(a)** | Compare Bilinear and Impulse Invariant transformation Techniques |
| **(b)** | Find the transfer function for the normalized butterworth filter for the order 3 |
| **6** | Apply the bilinear transformation to convert the analog filter with system function  H(s) =  into digital IIR filter. Select T=0.1 and compare the location of zeros in H(z) with the location of zeros obtained by applying the impulse invariance method in the conversion of H(s). |
| **7(a)** | Apply bilinear transformation to H(s) with T=1sec and find H(z). |
| **(b)** | Apply Impulse Invariant transformation Technique to H(s) with T=1sec and find H(z). |
| **8** | Make use of the bilinear transformation to convert the analog filter with system function  H(s) = into digital IIR filter. The digital filter should have a resonant frequency of |
| **9** | Design an analog butterworth filter that has a -2 dB or better cutoff frequency of 20 rad/sec and atleast -10 dB of attenuation at 30 rad/sec |
| **10** | The normalized transfer function of an analog filter is given by simplify for digital filter by applying suitable analog to digital transformation technique to convert the analog filter to digital filter with a cutoff of 0.4 |
| **11** | Design an analog band pass filter with the following characteristics   1. A -3dB upper and lower cutoff frequency of 50 hz and 20khz 2. A stop band attenuation of atleast 20 db at 20hz and 45khz 3. A monotonic frequency response. |
| **12** | Examine the frequency wrapping effect on frequency response of an IIR filter and derive an expression using Bilinear transformation technique |
| **13** | Distinguish between Butterworth and Chebyshev filter Approximations. |

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| **UNIT-IV** | |
| **1(a)** | Explain the characteristics of FIR digital filters. |
| **(b)** | Calculate group delay and phase delay of FIR filter defined by its difference equation y[n] = 0.25x[n] + x[n-1] + 0.25x[n-1] |
| **2** | Compare IIR and FIR filters. |
| **3** | Explain Frequency sampling method |
| **4** | Compare various windowing techniques |
| **5** | Make use of Fourier series method design an ideal Low Pass Filter with a frequency response  Find the values of h[n] for N=9 and plot the Magnitude response. |
| **6** | Make use of Fourier series method design an ideal High Pass Filter with a frequency response  Find the values of h[n] for N=9 and plot the Magnitude response. |
| **7** | Make use of Fourier series method design an ideal Band Pass Filter with a frequency response  Find the values of h[n] for N=9 and plot the Magnitude response. |
| **8** | Make use of Fourier series method design an ideal Band Stop Filter with a frequency response  Find the values of h[n] for N=9 and plot the Magnitude response. |
| **9** | Simplify for the realizable transfer function Hꞌ[z] from the given ideal high pass filter with a frequency response using Hamming window for N=9.  Hd()= |
| **10** | Simplify for the realizable transfer function Hꞌ[z] from the given ideal low pass filter with a frequency response using Hanning window for N=9. |
| **11** | Simplify for the realizable transfer function Hꞌ[z] from the given ideal Band pass filter with a frequency response using Bartlett Window for N=9. |
| **12** | Simplify for the realizable transfer function Hꞌ[z] from the given ideal Band stop filter with a frequency response using Rectangular Window for N=9 |
| **13** | Simplify for the realizable transfer function Hꞌ[z] from the given ideal low pass filter with a frequency response using Blackman window for N=9. |

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| **UNIT-V** | |
| **1** | Explain Multiplier and Multiplier Accumulator (MAC) |
| **2** | Explain modified bus structures and memory access schemes in P-DSPs |
| **3** | Explain Central Arithmetic Logic Unit and Auxiliary Register Unit |
| **4** | Explain special addressing modes in P-DSPs. |
| **5** | What are the advantages of DSP processors over conventional microprocessors? |
| **6** | Make use of a block diagram explain the architecture of TMS320C5X processor. |
| **7** | Construct the pipelined MAC configuration to perform convolution operation and explain with neat timing diagrams. |
| **8** | Identify various registers in TMS320C5X processor and explain. |
| **9** | Identify on-chip peripherals in DSP processors and explain. |
| **10** | Categorize memory access schemes in DSP’s and explain. |
| **11** | Categorize various interrupt types supported by TMS320C5X processor. |
| **12** | List out various addressing modes in P-DSPs and Explain any three in detail |
| **13** | Analyze the concept of pipelining in DSP processors. |

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| **UNIT-VI** | |
| **1** | Explain the need for anti –aliasing filter prior to down sampling and explain Decimation |
| **2** | Explain the need for anti –imaging filter after up sampling and explain Interpolation |
| **3** | With a neat sketch, explain about the spectral subtraction technique for speech enhancement? |
| **4** | Define Short-Time Fourier Transform. Also explain the Fourier transform interpretation of Short-Time-Fourier-transform (STFT)? |
| **5** | Obtain the necessary expressions for Decimation and Interpolation process. |
| **6** | Model an expression for the spectrum of output signal of a decimator. |
| **7** | Identify the need of multi-rate signal processing? Explain in detail. |
| **8** | Model an expression for the spectrum of output signal of a interpolator. |
| **9** | For a given ramp sequence r[n] Examine and sketch the up-sampling and down-sampling sequences for k=3. |
| **10** | Analyze the need of sampling rate conversion? Explain in detail. |
| **11** | List the various applications of multi-rate DSP system? Explain any one in detail. |
| **12** | Consider a multi rate system shown in figure. Examine y[n] in terms of x[n].  x[n]  **2**  **Z-1** **Z-1**  **2** **3**  **2**  **Z-1** **Z-1**  **Z-111**  **2**      y [n] |