University of Mumbai

Examination First Half 2022

Program: Electronics and Telecommunication Engineering

Curriculum Scheme: (R- 16) (C Scheme)

Examination: TE Semester V

Course Code: ECC504 and Course Name: Discrete Time Signal Processing

Time: 2 hour 30 minutes Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Consider two real sequences $x_1(n)$ and $x_2(n)$ with their DFTs $X_1[k]$ & $X_2[K]$ respectively. If $x[n]=ax_1[n]+bx_2[n]$ then what is X(k)
Option A:	$[X_1(k)+ X_2(k)]$
Option B:	$[aX_1(k)+ bX_2(k)]$
Option C:	$[X_1(k)/a+ X_2(k)/b]$
Option D:	$[aX_1(k)-bX_2(k)]$
2.	Find the IDFT of the given sequence X (k) = {10.-2+2j, -2, -2-2j}
Option A:	[1,2,3,4]
Option B:	[3,4,2,1]
Option C:	[4,3,2,1]
Option D:	[0,1,0,3]
3.	For mapping from analog domain to digital domain i. e. $s=\sigma+j\Omega$ and $z=re^{j\omega}$, then what is the condition on σ if r>1?
Option A:	$\sigma > 0$
Option B:	$\sigma < 0$
Option C:	$\sigma > 1$
Option D:	$\sigma > 1$
4.	The nonlinear relation between the analog and digital frequencies is called
Option A:	Aliasing
Option B:	Anti- aliasing
Option C:	Frequency Warping
Option D:	Mapping
5.	The number of complex additions that we need to perform in the linear filtering of any sequence using the FFT algorithm would be:
Option A:	$N\log_2 N$
Option B:	$(N/2)\log_2 N$
Option C:	$2N\log_2 N$
Option D:	(N/2)logN
6.	If DFT of x[n] = {1, 2, 3, 4}is X(k)= {10, -2+2j, -2, -2-2j}. Which property of DFT will result into DFT of x1[n] is X1(k) = {-2, -2-2j, 10, -2+2j}?
Option A:	Time Reversal
Option B:	Complex Conjugate

Option C:	Frequency shifting
Option D:	Time shifting
7.	The location of compulsory zero in a Type II linear phase FIR filter is at_____ and in Type IV is at _____
Option A:	$z = -1,\ z = +1$
Option B:	$z = +1,\ z = -1$
Option C:	$z = \pm 1$, No compulsory zeros
Option D:	No compulsory zeros, $z = \pm 1$
8.	_____is a method where the speech signal is subdivided into several frequency bands and each band is digitally encoded separately with different number of bits.
Option A:	Quantization
Option B:	Sub band Coding
Option C:	Filtering
Option D:	Truncation
9.	Why rounding is preferred than truncation for quantization.
Option A:	Quantization error will be more in rounding than in truncation
Option B:	Quantization error will be less in rounding than in truncation
Option C:	Rounding is easy
Option D:	Rounding required less time.
10.	In the cascaded form of realization, the polynomials are factored into
Option A:	a product of 1st-order and 2nd-order polynomials
Option B:	a product of 2nd-order and 3rd-order polynomials
Option C:	sum of 1st-order and 2nd-order polynomials
Option D:	sum of 2nd-order and 3rd-order polynomials

For Q2 to Q4 Each 20 Marks, Use any of the Following Format

Q2	**Solve any Four out of Six** **5 marks each**
A	Determine circular convolution of the sequences $x_1(n)$ and $x_2(n)$ using DFT/IDFT only $x_1(n)$= [1, 2, 3, 1] and $x_2(n)$= [4, 3, 2, 2]
B	What are linear phase filters? What conditions are to be satisfied by the impulse response in order to have LP? Define phase delay and group delay.
C	For the analog transfer function H(S), Determine H(z) using impulse invariance method. Assume T=1sec. $H(s) = \frac{1}{(s+1)+(s+2)}$
D	For the given transfer function of discrete time causal system $H(z) = \frac{1 - z^{-1}}{1 - 0.2z^{-1} - 0.15z^{-2}}$ Draw cascade and parallel realization.
E	Explain Application of DSP for ECG signals analysis.
F	Short note on finite word length effect in digital filters.

Q3	Solve any One Questions out of Two 10 marks each
A	Find linear convolution using overlap add and overlap-save method x(n)=[1,2,-1,2,3,-2,-3,-1,1,1,1,2,1] and h(n)=[1,2,3].
B	Determine the filter coefficient hd(n) for the desired frequency response of low pass filter given by $H(e^{jw}) = e^{-3jw} \quad \frac{-\pi}{2} \leq w \leq \frac{\pi}{2}$ $= 0 \quad \frac{\pi}{2} \leq w \leq \pi$ Also find transfer function using hanning window.

Q4 A	Solve any One Questions out of Two 10 marks each
i	Find the order and cut off frequency of Butterworth digital filter with $0.8 \leq \lvert H(e^{jw}) \rvert \leq 1 \quad 0 \leq w \leq 0.2\pi$ $\lvert H(e^{jw}) \rvert \leq 0.2 \quad 0.6\pi \leq w \leq \pi$ using IIM and BLT method.
ii	An eight-point sequence x_1(n)= [1,2,3,4,5,6,7,8] a) Find the DFT of x_1(n) i.e. $X_1(k)$using DIT FFT technique. b) Let x_2(n)=[5,6,7,8,1,2,3,4] using appropriate DFT property and answer of part a determine $X_2(k)$.
Q4 B	**Solve any Two Questions out of Three 5 Marks each**
i	One of the zeros of causal LP FIR filter is at $0.5e^{j\pi/3}$. Show the locations of other zeros and hence find the transfer function and impulse response of the filter.
ii	A cascade realization of two first order digital filters are $H_1(z) = \frac{1}{1-0.9z^{-1}}$ and $H_1(z) = \frac{1}{1-0.8z^{-1}}$. Determine the overall o/p noise power.
iii	Write a short note on frequency sampling realization of FIR filters.