University of Mumbai

Examination First Half 2022

Program: Electronics and Telecommunication Engineering

Curriculum Scheme: (R- 19) (C Scheme)

Examination: TE Semester V

Course Code: ECC502 and Course Name: Discrete Time Signal Processing

Time: 2 hour 30 minutes Max. Marks: 80

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	If discrete time signal x[n] is real with its N-point DFT as X(k), what is the DFT of x[-n]?
Option A:	X(-k)
Option B:	-X(k)
Option C:	X(k)
Option D:	NX(k)
2.	An FIR filter which has the following property $\lvert\angle H(0) - \angle H(\pi)\rvert = 0$ behaves like an
Option A:	Maximum phase system
Option B:	Minimum phase system
Option C:	Mixed phase system
Option D:	Zero phase system
3.	The filter with difference equation y(n) = x(n) + x(n-1) is defined as
Option A:	FIR Low pass filter
Option B:	FIR High Pass filter
Option C:	IIR Low pass filter
Option D:	IIR High Pass filter
4.	Round off error for sign magnitude and 2's complement binary number representation with b number of bits is given by
Option A:	$-\left(\frac{2^{-b}}{2}\right) \leq \epsilon_R \leq \left(\frac{2^{-b}}{2}\right)$
Option B:	$-(2^{-b}) \leq \epsilon_R \leq 0$
Option C:	$-(2^{-b}) \leq \epsilon_R \leq (2^{-b})$
Option D:	$-(2^{+b}) \leq \epsilon_R \leq 0$
5.	The magnitude response of Butterworth filter has
Option A:	monotonous stop-band and pass-band with ripples
Option B:	monotonous pass band and stop-band with ripples
Option C:	monotonous stop band and monotonous pass band
Option D:	pass-band with ripples and stop-band with ripples
6.	Coefficient symmetry is important in FIR filters to provide
Option A:	less stopband attenuation
Option B:	less passband ripple
Option C:	a smaller transition bandwidth
Option D:	a linear phase response

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7.	The DFT of discrete time sequence $x[n] = \delta[n] + 3\delta[n-1] - 2\delta[n-2] + 4\delta[n-3]$ is
Option A:	{6, -1+3j, 8, -1-3j}
Option B:	{6, 1-3j, 8, 1+3j}
Option C:	{6, 3-j, -8, 3+j}
Option D:	{6, 3+j, -8, 3-j}
8.	The abrupt spike present in EEG provides
Option A:	Information about abnormal heart rate
Option B:	Information about EEG rhythms
Option C:	Information about epilepsy condition
Option D:	Information about unconscious state of patient
9.	The anti-symmetric linear phase filter is given by {1 -2 0 2 -1}. Which type of linear phase FIR filter is it?
Option A:	Type 1
Option B:	Type 2
Option C:	Type 3
Option D:	Type 4
10.	Parallel realization is useful for
Option A:	reducing the number of multipliers and adders
Option B:	high speed filtering operation
Option C:	practical implementation of filter
Option D:	achieving a better efficiency of the filter

Q2	**Solve any Two Questions out of Three** **10 marks each**
A	Find the DFT of sequence x[n]={5, 2, 1, 3}. Using answer and not otherwise, Find i) x1[n]={5, -2, 1, -3} ii) x2[n]={2, 1, 3, 5} iii) x3[n]={5, 3, 1, 2}
B	The desired response of the low pass filter is $H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega} & -3\pi/4 \le \omega \le 3\pi/4 \\ 0 & Otherwise \end{cases}$ Design the filter using hamming window for M=5
C	Explain the concept of Lattice Ladder realization structure.

Q3	**Solve any Two Questions out of Three** **10 marks each**
A	Design a Butterworth low pass filter using Bilinear transformation for the following constraints (Assume T=1sec): $0.85 \le \lvert H(e^{j\omega}) \rvert \le 1 \quad for\ 0 \le \omega \le 0.2\pi$ $\lvert H(e^{j\omega}) \rvert \le 0.2 \quad for\ 0.6\pi \le \omega \le \pi$
B	Find the DFT of the following sequence using DIF-FFT x[n] = {1, 2, 3, 4, 0, 0, 0, 0 }
C	Draw the realization structure for following transfer function using parallel and cascade form? $H(z) = \frac{16z^{-2} + 8z^{-1} + 1}{(4z^{-2} + 4z^{-1} + 1)(2z^{-1} + 1)}$

Q4	**Solve any Four out of Six** **5 marks each**
A	Explain overlap save method of linear filtering using DFT with neat diagram.
B	Design a digital resonator for a frequency of 50 Hz.
C	One of the zeros of an asymmetric linear phase FIR filter is at 0.5. Find the location of other zeros. Determine transfer function.
D	Write a short note on DSP application for ECG signal.
E	For analog transfer function $H(s) = \frac{1}{(s+1)(s+2)}$ Determine H(z) using impulse invariant method. Assuse T=1 sec.
F	What is Quantization? Explain the different types of quantization error in FIR and IIR filtering?