B.E. (EXTC) (Sem-VIII) (CBCGS) 9281
Advanced Digital Signal Processing (DLOC)

University of Mumbai

Examinations Summer 2022

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.	Which of the following is the advantage of sampling rate conversion by converting the signal into analog signal
Option A:	Less signal distortion
Option B:	Quantization effects
Option C:	New sampling rate can be arbitrarily selected
Option D:	None of the mentioned
2.	Let the sampling frequency of a signal s(t) be 44.1 KHz. The sampling frequency of this signal needs to be up converted to 48KHZ. Find the interpolation (I) and decimation (D) factors.
Option A:	I=160, D=147
Option B:	I=147, D=160
Option C:	I=108, D=10
Option D:	I=48, D=44.1
3.	The non-parametric methods for power spectrum estimation suffer from _____.
Option A:	phase distortion
Option B:	spectrum leakage effects
Option C:	amplitude distortion
Option D:	None of the above
4.	The periodogram is _____.
Option A:	not a consistent estimate of the true power density spectrum
Option B:	a consistent estimate of the true power density spectrum
Option C:	not a consistent estimate of the true energy density spectrum
Option D:	a consistent estimate of the true energy density spectrum
5.	The second-order AR process u(n) is described by the difference equation **u(n) = – 0.5u(n-1) + u(n-2) + v(n);** where v(n) is a zero mena unit variance white process. The Correlation matrix is given as $\begin{bmatrix} 0 & r(1) \\ r(-1) & 0 \end{bmatrix}$ Then $r(1)$ would be
Option A:	0.5
Option B:	1
Option C:	-0.5
Option D:	-1
6.	Step size in LMS algorithm is bounded in upper side by which of the following relation
Option A:	$\mu < 0$
Option B:	$\mu < 1$
Option C:	$\mu < \frac{1}{\lambda_{min}}$

Option D:	$\mu < \frac{2}{\lambda_{max}}$
7.	In MRA _____ time resolution and _____ frequency resolution is employed at high frequencies
Option A:	Good, poor
Option B:	Poor, good
Option C:	Good, good
Option D:	Poor , poor
8.	If Φ(t) is the scaling function of Haar Wavelet, then Φ(t) and Φ(2t) are made orthonormal by multiplying Φ(2t) by
Option A:	2
Option B:	½
Option C:	√2
Option D:	1/√2
9.	Adaptive Equalization is used to compensate
Option A:	Peak signal to noise ratio
Option B:	Inter-symbol Interference
Option C:	Channel fading
Option D:	Noises present in the signal
10.	The forgetting factor ρ in RLS algorithm ensures
Option A:	Stability
Option B:	Minimum MSE
Option C:	that errors in the past get much lower weight as compared to errors in the present.
Option D:	that inputs in the past get much lower weight as compared to present inputs

Q2, (20 Marks Each)	**Solve any Two Questions out of Three** **10 marks each**
A	Design a two-stage decimator for the following specifications: $D = 100$ Passband: $0 \leq F \leq 50$ Transition band: $50 \leq F \leq 55$ Input sampling rate: 10,000 Hz Ripple: $\delta_1 = 10^{-1}$, $\delta_2 = 10^{-3}$
B	Derive the relation of the output y(n) with the input x(n) (time domain relation) for an a. Interpolator for an integer factor I b. Sampling rate convertor by a non-integer factor Also derive the spectrum of both
C	Prove the alias cancellation and perfect reconstruction condition for a 2 band quadrature filter bank in Haar MRA.

Q3 (20 Marks Each)	Solve any Two Questions out of Three 10 marks each
A	Derive LMS algorithm and explain its limitations
B	Consider an MA(1) process given below: $u(n) = v(n) - 0.4v(n-1)$ where v(n) is a zero mean white process with variance $\sigma_v^2 = 0.7$. Obtain the parameters and Correlation matrix for an equivalent 2nd order AR process.
C	Define Periodogram. Prove that periodogram is not a consistent estimator

Q4. (20 Marks Each)	*Please delete the instruction shown in front of every sub question*
A	**Write short notes on (Any two) 5 marks each**
i.	Applications of Signal Processing in Biomedical Application
ii.	Adaptive channel equalization
iii.	Image compression using wavelets
B	**Solve any One 10 marks each**
i.	Prove Weiner Hopf equation and derive the expression for MSE and minimum value of MSE
ii.	Compare Bartlett, Welch and Blackman Tukey methods of power estimation