GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

RM19002031

Registration No: | | | | | | | | | | |

Total Number of Pages : 2 **M.TECH**

M.TECH 2ND SEMESTER (AR 18) REGULAR EXAMINATIONS, APRIL/MAY 2019

ADVANCED DIGITAL SIGNAL PROCESSING

Branch: ECE, Subject Code:MECPC2020

Time: 3 Hours **Max Marks : 70**

PART-A (10 X 2=20 MARKS)

1. Answer the following questions.

a) What is Periodogram ? Write the expression for it.
b) An FIR filter with an odd number of taps will have a linear-phase shift function if the tap weights are symmetrical, i.e. $b_n = b_{M-n}$. Show this.
c) What is significance of selection of model order in parametric methods?
d) Why is oversampling used in DACs? Why is it used in ADCs?
e) Distinguish the difference between forward and backward prediction filter.
f) Give the impulse response of a Wiener filter**.**
g) Why is it that a "brick-wall" type filter cannot be implemented in practice?
h) What are the advantages of IIR filter?
i) What are the pros and cons of LMS?
j) What is the relation between DFT and FFT? What tricks are typically used by FFT?

PART-B (5 X 10=50 MARKS)

Answer any five questions from the following.

2. a) Let $x(n) = s(n) + v(n)$ with $R_v(z) = 1$, $R_{sv}(z) = 0$, and **[5]**

$$R_S(Z) = \frac{0.75}{(1 - 0.5Z^{-1})(1 - 0.5Z)}$$

Determine the optimum filters for the estimation of $s(n)$ and $s(n-2)$ from $\{x(k)\}_{-\infty}^{n}$ and the corresponding MMSEs.

b) (i)Show that a unit vector **w** is an eigenvector of the matrix $\mathbf{H} = \mathbf{I} - 2\mathbf{w}\mathbf{w}^H$. What is the corresponding eigenvalue? **[5]**

(ii) If a vector **z** is orthogonal to**w**, show that **z** is an eigenvector of**H**. What is the corresponding eigenvalue?

3.a) Solve the following LS problem **[5]**

$$\mathbf{X} = \begin{bmatrix} 1 & -2 & -1 \\ 2 & 0 & 1 \\ 2 & -4 & 2 \\ 4 & 0 & 0 \end{bmatrix} \qquad \mathbf{y} = \begin{bmatrix} -1 \\ 1 \\ 1 \\ -2 \end{bmatrix}$$

by computing the QR decomposition using the GS algorithm.

b) If $r(l) = \cos \omega_0 l$, determine the second-order prediction error filter and check whether it is minimum-phase. **[5]**

4.a) Evaluate the value of X (K) if x (n) = $(-1)^n$, $0 \leq n \leq 7$ using DIF-FFT algorithm**.** **[5]**

b) Explain about Decimation and interpolation with the help of polyphase filters**.** **[5]**

5. a) Determine the frequency resolution of Bartlett, Welch and Blackman-Tukey methods of power spectrum estimates for a quality factor Q=10. Assume that overlap in Welch method is 50% and length of sample sequence is 1024. **[5]**

b) Find a relationship between the minimum-norm pseudo spectrum and the all-pole model spectrum in the case of an infinite signal-to-noise ratio. **[5]**

6.a)Discuss the procedure for the design of IIR filters and what are the constraints in the design of IIR filters using analog structures . **[5]**

b) The exponential density function is given by **[5]**

$$f_x(x) = \frac{1}{a} e^{-x/a} u(x)$$

where *a* is a parameter and *u(x)* is a unit step function.

(*i*) Plot the density function for $a = 1$.
(ii) Determine the mean, variance, skewness,and kurtosis of the Rayleigh random variable with $a = 1$. Comment on the significance of these moments in terms of the shape of the density function.
(iii) Determine the characteristic function of the exponential pdf.

7. a) Derive the equations for the a priori RLS lattice-ladder algorithm with error feedback. **.** **[5]**

b) Determine the impulse response of an all-pole system with lattice parameters **[5]**

$k_1 = 0.2$ $k_2 = 0.3$ $k_3 = 0.5$ $k_4 = 0.7$

Draw the direct- and lattice form structures of the above system.

8. Write short notes on :
a) Optimum filters **[5]**
b) Lattice structures **[5]**

==0==