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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M. TECH. DEGREE EXAMINATION, JULY 2018

Electronics & Communication Engineering

(Communication Engineering & Signal Processing)

07EC6207 Advanced Digital Signal Processing

Max. Marks: 60 Duration: 3 Hours

Answer all six questions. Part 'a' of each question is compulsory

Answer either Part 'b' or Part 'c' of each question

Q. no.	Module 1	Marks
1a	Design a hamming windowed causal FIR low pass filter of length 17 for a cut off frequency $\omega_c = \pi/5$.	**4**
	Answer b or c	
b	Design a digital butterworth filter with $\boldsymbol{\omega_p = \pi/3}$, $\boldsymbol{\omega_s = 4\pi/9}$, maximum pass band attenuation = 3dB, minimum stop band attenuation = 10dB. Use bilinear transformation.	**5**
c	Explain Park-McClellan's algorithm	**5**

Q. no.	Module 2	Marks
2a	State and prove identities of multirate of operations	**4**
	Answer b or c	
b	x(t), which is bandlimited to 500Hz, is sampled at 1.5kHz to get x[n]. Draw the block diagram of a system which converts the sampling rate from 1.5kHz to 1kHz without aliasing. Derive the time domain expressions at the output of each block.	**5**
c	Draw the block diagram of a two-channel quadrature mirror filter bank. Derive the conditions on different filters for alias free reconstruction and perfect reconstruction.	**5**

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Q. no.	Module 3	Marks
3a	Find the Direct form filter coefficients of the three stage lattice filter with reflection coefficients $K_1 = 1/2$, $K_2 = -1/4$, $K_3 = 1/3$	**4**
	Answer b or c	
b	Draw the two stage lattice structure with coefficients K_1 and K_2. Derive the expressions for $f_2[n]$ and $g_2[n]$ in terms of the input x[n]. Hence find the relationship between forward and prediction error filters	**5**
c	Derive the normal equations for the coefficients of linear prediction	**5**

Q. no.	Module 4	Marks
4a	Explain Schur algorithm. Using it, find the expressions for K_1 and K_2	**4**
	Answer b or c	
b	Derive the recursive equations to find the prediction error filter coefficients by Levinson-Durbin algorithm.	**5**
c	State and explain the minimum phase property and whitening property of forward prediction error filter, and orthogonality of backward prediction error filter	**5**

Q. no.	Module 5	Marks
5a	Describe the Bartlett method of power spectrum estimation.	**5**
	Answer b or c	
b	Explain the computation of energy density spectrum. What are the effects on energy density spectrum when windowed signal is used?	**7**
c	Explain the performance characteristics of different non-parametric power spectrum estimates.	**7**

Q. no.	Module 6	Marks
6a	What are the different criteria for choosing AR model order?	**5**
	Answer b or c	
b	Explain Burg method for estimating AR model parameters.	**7**
c	Describe ARMA model for power spectrum estimation.	**7**