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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2017

Electronics and Communication Engineering

1.Applied Electronics And Instrumentation

2. Telecommunication Engineering

01EC6105 Advanced Digital Signal Processing

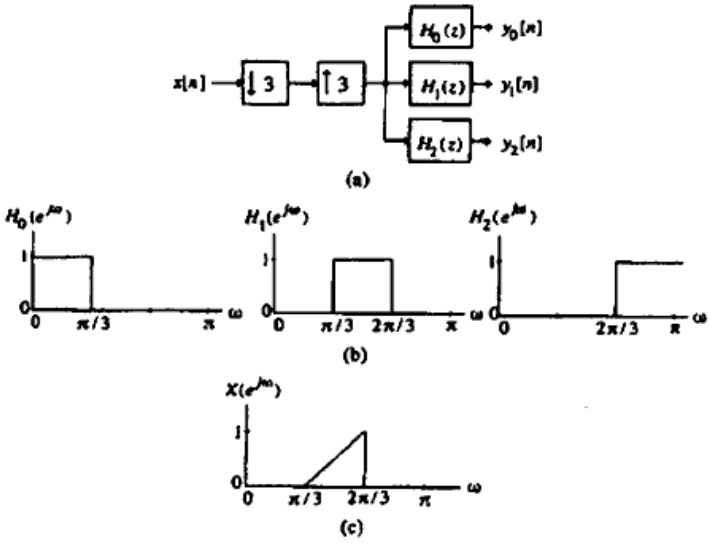
Answer *any two full* questions from *each* part

Limit answers to the required points.

Max. Marks: 60 Duration: 3 hours

PART A

1. a. Consider the structure shown below with input transforms and filter responses as indicated.
Sketch the quantities $Y_0(e^{j\omega}), Y_1(e^{j\omega}), Y_2(e^{j\omega})$ and interpret. 4



b. Implement a 2 band polyphase decomposition on 5

$$H(z) = \frac{2 + 3.1z^{-1} + 1.5z^{-2}}{1 + 0.9z^{-1} + 0.8z^{-2}}$$

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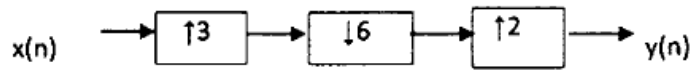
2. a. For the following multirate system develop an expression for x(n) as a function of y(n) 3



b. Explain noble identities. 6
How can the noble identities be used for efficient structures for decimator and interpolator? Give illustrations.

3. a. Explain the polyphase implementation of Uniform Filter Bank. Sketch the analysis section of an M channel filter bank with IDFT block 4

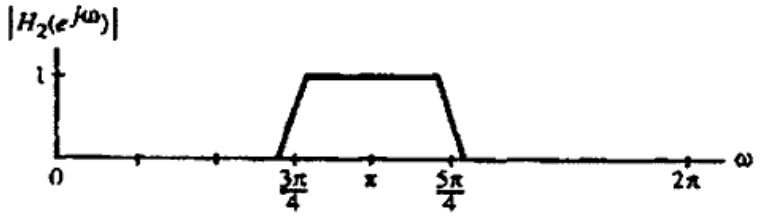
b. A four channel analysis uniform DFT filter bank has a set of filter transfer functions

$H_k(z)$, k=0,1,2,3 and $H_0(z)$ has polyphase components given as

$E_0(z)=1+3z^{-1}-0.8z^{-2}$ $E_1(z)=2-1.5z^{-1}-3.1z^{-2}$
$E_2(z)=4-0.9z^{-1}+2.3^{-2}$ $E_3(z)=1+3.7z^{-1}+1.7z^{-2}$

i) Determine $H_0(z)$, $H_1(z)$, $H_2(z)$, $H_3(z)$

ii)If $H_2(z)$ has the magnitude response given as sketch the same for $H_0(z)$, $H_1(z)$, $H_3(z)$ 5



PART B

4. a. State and prove Heisenberg's uncertainty principle. 5
Explain how it put restriction on spectral analysis of signals.

b. Explain the axioms of MRA 4

5. a. Give the filter bank implementation of STFT. 4

b. Explain the 2 dimensional DWT decomposition of a 512x512 image. Give the filter bank structure. Explain the 2 dimensional DWT decomposition of a 512x512 image. Give the filter bank structure. 5

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6. a How is progressive encoding possible in a wavelet decomposed image? Given a DWT coefficient array for 3 levels on an image. Implement EZW or SPIHT algorithm for coding the image (do atleast 2 dominant passes). 9

127	69	24	73	13	5	-8	5
-37	-18	-18	8	-6	7	15	4
44	-87	-15	21	8	-11	14	-3
55	18	29	-56	0	-2	3	7

34	38	-18	17	3	-9	-2	1
-27	-41	11	-5	0	-1	0	-3
6	17	5	-19	2	0	-3	1
32	26	-7	5	-1	-5	7	4

PART C

7. a. Explain the Yule Walker equations in the Autoregressive power spectral density estimate How can you estimate the parameters and give the corresponding power spectrum estimate? 6

b. Explain LMS algorithm. Give application. 6

8. a. How is Blackman and Tuckey method used in smoothening the periodogram ? 6

b. State and prove Widrow Hopf equation for adaptive filtering. 6

9. a. Explain power spectrum estimation using window method. 4

b. Derive the relation between autocorrelation and spectral density. 4

c. How can a linear predictor implemented using FIR filter with lattice structure? 4

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