Roll No .....

MTDE/MEDI/MTEI - 202

M.E./M.Tech. II Semester

Examination, December 2015

Advance Digital Signal Processing

Time : Three Hours

Maximum Marks : 70

Note : Attempt any five questions. Each question carry equal marks.

1. a) Explain about the computational requirements (real and complex multiplication and division) addition for direct computation of N-point DFT of a sequence $x(n)$. 7

   b) Compute $x(n)$ by using Decimation in frequency if corresponding DFTR is $x(k) = [7, 1, 3, 1]$. 7

2. a) Convert the analog filter with system function

$$H(s)=\frac{s+0.1}{(s+0.1)^2+9}$$

into a digital IIR filter. The digital filter should have a resonant frequency of $\omega_r=\frac{\pi}{4}$. 7

b) A low pass filter is to be designed with following desired frequency response

$$H_d(e^{j\omega})=\begin{cases} e^{-j2\omega}, -\pi/4 \le \omega \le \pi/4 \\ 0 \quad , \pi/4 < |\omega| \le \pi \end{cases}$$

Determine the filter coefficients $h_d(n)$ if the window function is defined as

$$\omega(n)=\begin{cases} 1, 0 \le n \le 4 \\ 0, \textit{otherwise} \end{cases}$$

Also determine the frequency response $H(e^{j\omega})$ of designed filter. 7

3. a) Draw and explain block diagram of multirate stage decimator and interpolator. 7

b) The bandwidth of a sequence $x(n)$ is 3.4 kHz and it's sampling rate is to be reduced, by decimation from 240 kHz to 8 kHz. Assume that an optimal FIR filter is to be used, with an overall pass band ripple 0.08 and stop band ripple 0.001. Design an efficient three stage decimator and hence calculate multiplications per second. 7

4. a) Explain how Alias Free QMF filterbank realisation is achieved? 7

b) Design a five channel filter bank. 7

5. a) Discuss various properties of CWT. 7

b) How is discrete wavelet transform obtained from dyadic sampling. 7

6. a) What is frequency warping and pre-warping. 7

b) Write the properties of Butterworth Filter. 7

7. a) Design a FIR low pass filter using Hamming window by taking M = 7 and response as

$$H_{d'}(e^{j\omega})=\begin{cases} e^{-j3\omega}, -3\pi/4 \le \omega \le 3\pi/4 \\ 0 \quad , 3\pi/4 < |\omega| \le \pi \end{cases}$$

Also determine $H(e^{jw})$ 7

b) What is the need of sampling rate conversion? 7

8. a) With a neat block diagram explain decimation by a factor D of sampling rate conversion technique. 7

b) Write short note on: 7

i) Chirp Z - transform

ii) Least square method.

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