Total No. of Questions : 6]

SEAT No. :

P87

[Total No. of Pages : 2

OCT. -16/BE/Insem. - 143

B.E. (E & TC)

MULTI-RATE AND ADAPTIVE SIGNAL PROCESSING

(2012 Course) (Semester - I) (404185A) (Elective-II)

Time : 1 Hour] *[Max. Marks :30*

Instructions to the candidates:

1) ***Figures to the right indicate full marks.***
2) ***Assume suitable data, if necessary.***

Q1) a) Sketch the amplitude spectrum of Harr wavelet function belonging to subspace W_{-1} and W_1. **[5]**

b) Find out the time variance of Harr scaling function belonging to subspace V_0. **[5]**

OR

Q2) a) Explain the limitation of Fourier Transform with suitable example. **[5]**

b) Find out the projection of $x(t)$ using Harr scaling function belonging to subspace V_0. Sketch the projection and write down the equation of $x(t)$ using basis of subspace V_0 **[5]**

Where $x(t) = 2t \quad 0 \le t \le 1$

$2 \quad 1 \le t \le 2$

$0 \quad$ elsewhere

Q3) The sampling rate of a signal $x(n)$ is to be reduced, by decimation, from 96 kHz to 1 kHz. The highest frequency of interest after decimation is 450 Hz. Assume that an optimal FIR filter is to be used, with an overall pass band ripple, $\delta_p = 0.01$, and passband deviation, $\delta_s = 0.001$. Find out

a) Order of filters required for a two stage decimator.

b) Multiplications per second (MPS) and Total Storage Requirements (TSR) for a two stage decimator.

Note: passband and stopband ripple specified in a problem are for one stage decimator. Decimation factors are 32 and 3 respectively for a two stage decimator. **[10]**

OR

P.T.O.

Q4) a) Derive the equation for an input-output of a down sampler in frequency domain. Assume down sampling factor of two. **[5]**

b) Explain polyphase structure for an Interpolator with suitable example. **[5]**

Q5) a) Find analytic signal and instantaneous frequency of

$y(t) = \cos(150t) \cos(250t)$. **[5]**

b) Discuss the effect of window size on STFT resolution. **[5]**

OR

Q6) a) Derive the expression for analytic (complex) signal. **[5]**

b) Explain Continuous Wavelet Transform (CWT) equation. Clearly indicate the effect of time scaling parameter on the tiling diagram of CWT. **[5]**

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