

Total No. of Questions : 6]

SEAT No. :

P87

OCT. -16/BE/Insem. - 143

[Total No. of Pages : 2

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 $x(t) = 2t$ $0 \leq t \leq 1$

2 $1 \leq t \leq 2$

0 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]

