Sub Code: REC503

Paper Id: 130508 Roll No:

B TECH

(SEM V) THEORY EXAMINATION 2019-20

DIGITAL SIGNAL PROCESSING

Time: 3 Hours ***Total Marks: 70***

Notes:

- *Attempt all Sections. Assume any missing data.*

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a.	Define linear convolution and its physical significance.
b.	What are advantages & disadvantages of window methods?
c.	What are the advantages of representing the digital system in block diagram form?
d.	Write the expression for Blackman and Bartlett window.
e.	If x(n) = {4,3,5,7,4,6} & up sampling factor=3, then what will be the value of up sampler output.
f.	If x(n)={1,5,2,3} what will be $x((3-n))_4$?
g.	Write down the advantages & disadvantages of bilinear transformation.

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a.	Obtain the parallel form realization for the system function given below: $$H(z) = \frac{(1+0.25z^{-1})}{(1+0.5z^{-1})(1+0.5z^{-1}+0.25z^{-2})}$$
b.	What the relation between DTFT and DFT. Explain the properties of DFT with examples.
c.	Explain the Gibbs phenomenon. Find the response of rectangular window and explain it.
d.	Find the 4-pointcircular convolution of x(n) an h(n) given by x(n)={1,1,1,1} & h(n)={1,0,1,0} using radix-2 DIF-FFT algorithm.
e.	The system function of analog filter is given by $$H(s) = \frac{(s+0.1)}{(s+0.1)^2+16}$$ Obtain the system function of digital filter by using impulse invariant technique. Assume T=1sec.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a)	Obtain the ladder structure of a given transfer function: $$H(z) = \frac{2+8z^{-1}+6z^{-2}}{1+8z^{-1}+12z^{-2}}$$
(b)	Obtain a linear phase and cascade realization of the system $$H(z) = (1+0.5z^{-1}+z^{-2})(1+0.5z^{-1}+z^{-2})$$

4. Attempt any *one* part of the following: 7 x 1 = 7

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(a)	Design a Butterworth low pass analog filter for the following specification: (i) Pass band gain required:0.9 (ii) Frequency up to which pass band gain must remain more or less steady :100 rad/sec (iii) Gain in attenuation band:0.4 (iv) Frequency from which the attenuation must start: 200 rad/sec
(b)	What is frequency warping effect? How this problem is overcome in bilinear transform method of IIR filter design? Also write down the advantages & disadvantages of bilinear transformation.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a)	A FIR filter has following symmetry in impulse response: h(n)= h(M-1-n) for M Even. Derive its frequency response and show that it has linear phase.
(b)	Design a low pas discrete time filter with following specification: $0.99 \leq \lvert H(e^{j\omega}) \rvert \leq 1.01$ $\lvert\omega\rvert \leq 0.4\pi$ $\lvert H(e^{j\omega}) \rvert \leq 0.01$ $0.6\pi \leq \lvert\omega\rvert \leq \pi$ Use Kaiser Window for design.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a)	Find the 8-pint DFT of $x(n)=2^n$ by using DIT FFT algorithm.
(b)	Prove that multiplication of DFTs of two sequences is equivalent to the circular convolution of the two sequences in time domain.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a)	Write a short note on (i) Sub-band coding of speech signal (ii) Quadrature mirror filter.
(b)	Explain the phenomenon decimation and interpolation by suitable example.