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PES Institute of Technology, Bangalore

(Autonomous Institute under VTU, Belgaum)

EE 303

...STER-END EXAMINATION (SEE) B. E. V SEMESTER (SUMMER TERM) – AUGUST 2010

EE 303 – DIGITAL SIGNAL PROCESSING

...3 Hrs | Answer All Questions | Max Marks: 100

a)	Let $x(n) = \{3,1,2,1\}$ and $y(n) = \{1,2,2,1\}$. Find their circular convolution using DFT and IDFT operations.	8
b)	Let $X(k)$ be the DFT of $x(n) = \{0,1,2,2,1,1\}$. What is the IDFT of (i) $(-1)^k X(k)$ (ii) $X(k+3)$	6
c)	Find the output if $x(n) = \{2,3,-2,1,-1,0,4\}$ is filtered with $h(n) = \{2,1,-1\}$, using the overlap-add method. Consider 4 input samples at a time.	6
a)	Find the 8-point DFT of $x(n) = \{0,2,2,-2,0,2,-2,-2\}$, using the DIT-FFT algorithm.	8
b)	Find the DFTs of $x(n) = \{1,1,-3,-1\}$ and $y(n) = \{1,2,2,1\}$ using a single 4-point DIF-FFT.	8
c)	If a 15-point DFT is implemented as a combination of 3-point and 5-point DFTs, how many multiplications and additions are required?	4
a)	Consider the FIR filter with impulse response $h(n) = \begin{cases} 1 - \cos\frac{2\pi n}{64} & 0 \le n \le 63 \\ 0 & otherwise \end{cases}$ Draw the frequency sampling structure for the filter.	8
b)	For the system described by the difference equation given below, draw the following realizations: (i) direct form I, (ii) transposed direct form I and (iii) parallel. $y(n) = 2x(n) + \frac{9}{4}x(n-1) - \frac{1}{4}x(n-2) - \frac{1}{4}y(n-1) + \frac{1}{8}y(n-2)$	12
a)	Verify whether a linear phase FIR filter with an even number of symmetric coefficients can be used to design a highpass filter.	4
b)	Design a linear phase lowpass filter of length 7, with a cutoff frequency of $\omega_c = 3\pi/4$ rad/sample. Use the window function that gives the best transition band.	8
c)	Use the frequency sampling method to obtain a 7-length lowpass linear phase filter with a cutoff frequency of $\omega_c = \pi/2$ rad/sample.	8
a)	Derive the bilinear transformation for obtaining IIR filters from analog filters. Verify the stability of the mapping. What is the relation between the analog and discrete frequency variables?	12
b)	Use the impulse invariant transformation to transform the following analog filter to a digital filter. Take $T = 0.1$ sec. $H_a(s) = \frac{s+1}{s^2+5s+6}$	8