Question Paper

Exam Date & Time: 27-Jun-2022 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

Manipal School of Information Sciences (MSIS), Manipal
Second Semester Master of Engineering - ME (Embedded Systems) Degree Examination - June 2022

Digital Signal Processing [ESD 5001]

Marks: 100 **Duration: 180 mins.**

Monday, June 27, 2022

Answer all the questions.

1)	Compute the DFT of the sequence x (n) = [1, -1, -1, -1, 1, 1, 1, -1] using DIT-FFT algorithm. Draw the flow graph indicating the intermediate values. (TLO 2.1 - CO1)	(10)
2)	Show the realization of the following system functions using Direct form-I, Direct form-II, Cascade and Parallel form $H(z) = [0.8 / (1 + 0.2z^{-1} + z^{-2})] + [1.0 / (1 - 0.5z^{-1} + z^{-2})]$ (TLO 3.1 - CO2)	(10)
3)	Show the frequency sampling structure of linear phase FIR filter having symmetric response for both even and odd number of filter coefficients. (TLO 4.1 - CO2)	(10)
4)	Design a band-pass FIR filter for the following desired frequency response. $H(e^{j\Omega}) = e^{-j\Omega}$ for $\Omega_{c1} \leq \lvert\Omega\rvert \leq \Omega_{c2}$ = 0 Otherwise Where = 4, Ω_{c1} = 1 rad/sec, Ω_{c2} = 3 rad/sec. Assume suitable Sampling Frequency. Use Hamming window. (TLO 4.2 - CO2)	(10)
5)	Design and realize a digital Butterworth filter for the following specification. The sampling frequency is 1000 rad/sec. Use Impulse Invariance transformation. (TLO 5.1 - CO2) $\lvert H(j\Omega)\rvert \geq$ -2 dB $0 \leq \Omega \leq 10$ rad/sec $\lvert H(j\Omega)\rvert \leq$ -50 dB $\Omega \geq 100$ rad/sec	(20)
6)	Discover poly-phase filter structures of interpolator and decimator. Explain how these structures are in a position to provide the required sampling rate conversion. (TLO 6.1 - CO3)	(10)
7)	What are QMF filter banks? Apply multi-rate signal processing to obtain the expression for the spectrum of the output of the QMF filter bank. (TLO 6.2 - CO3)	(10)
8)	Explain analytically, how optimum filter coefficients are obtained on Mean Square Error sense in Wiener Predictor Configuration. (TLO 7.1 - CO3)	(10)
9)	Explain the TMS320C6X DSP processor pipelining operation. (TLO 8.2 - CO4)	(10)

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