Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FOURTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
MAY/JUNE 2016
SUBJECT: DIGITAL SIGNAL PROCESSING (ECE - 2203)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A.	Consider the difference equation $y[n]+y[n-2] = x[n]+x[n-1]$. If $x[n]=10u[n]$, and $y[-2] = -10$ and $y[-1]=0$, find the output sequence $y[n]$ for $n \geq 0$.
1B.	Consider the sequence $x[n] = \delta[n] + 2\delta[n-2] + \delta[n-3]$. If $y[n]$ is the four-point circular convolution of $x[n]$ with itself, find $y[n]$ and its four point DFT $Y[k]$.
1C.	Consider a system function of a causal system $H(z)=\dfrac{1+z^{-2}}{1-0.9z^{-1}}$. Plot its poles and zeros and describe the filtering characteristics of this system.
	(5+3+2)
2A.	Starting from the DFT expression, develop the radix 2 decimation in frequency FFT algorithm and show the complete butterfly diagram of computation of an 8 point DFT.
2B.	Find the N point DFT of the sequence $x[n] = 4+\cos^2(2\pi n/N)$, $n = 0,1,2, \ldots. N-1$.
2C.	Let the time taken for a complex multiplication be $1\mu s$. What is maximum time taken for multiplications if a 512 point DFT is computed directly? How much it would be if radix 2 decimation in time FFT algorithm is used?
	(5+3+2)
3A.	Explain Type-I Chebyshev analog low-pass filter response. Discuss the steps involved in obtaining the transfer function of such filters.
3B.	The system function of an analog filter is given as $H(s)=\dfrac{s+0.2}{s^2+0.4s+9.04}$. Convert this analog filter to digital using impulse invariance technique. Assume T= 1 second.
3C.	Determine the zero locations of notch filter to eliminate the frequency $\omega_0 = \dfrac{\pi}{4}$ *radians*. Write down the system function for a second order pole-zero notch used for this purpose.
	(5+3+2)
4A.	Derive the expression for the frequency response of an even length, linear phase FIR filter with symmetric impulse response.
4B.	A low-pass filter has the desired frequency response $H_d(e^{jw}) = \begin{cases} e^{-j3w} & ,0 \leq \lvert w \rvert \leq \frac{\pi}{2} \\ 0, & elsewhere \end{cases}$, in [π, -π] Determine the filter coefficients using non-recursive frequency sampling method.

4C.	If one of the zeros of a linear phase, real coefficient, length 5 FIR filter is $0.5e^{\frac{j\pi}{4}}$, show all the zeros of this filter in the *z*-plane and write the system function.
	(5+3+2)
5A.	Consider an FIR lattice filter with coefficients K_1 = 0.6, K_2 = -0.3, and K_3 = 0.8. Draw the lattice structure. Obtain and draw the tapped delay line structure.
5B.	Explain the principle of parametric method of PSD estimation. Bring out the main advantages of this technique.
5C.	List the performance metrics of PSD estimation techniques.
	(5+3+2)