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MID SEMESTER EXAMINATION-2015

M.Tech (Second Semester)

COURSE CODE: 10M11EC211 MAX. MARKS: 30

COURSE NAME: Advanced Digital Signal Processing

COURSE CREDITS: 03 MAX. TIME: 2 HRS

Note: All questions are compulsory.

Section A. Each question carries half mark. Write very precisely.

1. What are the properties of twiddle factor?
2. Give the expression for complex convolution of two signals.
3. What is the difference between windowing and filtering?
4. How do you improve the frequency resolution in Discrete Fourier Transform?
5. Find the group delay for a digital system with impulse response $h[n] = \begin{cases} 1 & 0 \le n \le 4 \\ 0 & otherwise \end{cases}$
6. Give the chart showing the symmetry properties of Fourier transforms relating time domain and frequency domain.
7. Draw any structure for an LTI system with input and output relation as $y[n] + 0.1\,y[n-1] - 0.06\,y[n-2] = x[n] - 2x[n-1]$.
8. Draw the frequency response of the system if its z-transform has poles at $e^{\pm j\frac{\pi}{4}}$, $e^{\pm j3\frac{\pi}{4}}$ and zeros at $e^{\pm j\frac{\pi}{2}}$, 1 and -1 in the z-plane.
9. Give the formula to make a signal as a periodic extension and circular periodic extension.
10. Give the relation between z-transform and Laplace transform.
11. What can be the effect of quantization in digital filter design?
12. How to avoid aliasing in frequency domain?

Section B. Each question carries three marks.

1. Draw the chart giving the relationships between time domain and frequency domain for a continuous time signal and its sampled version(discrete signal) with all the details.(Fourier Family chart).

2. Let $x[n] = \begin{cases} 1 & 0 \le n \le N-1 \\ 0 & otherwise \end{cases}$ and $h[n] = \begin{cases} n+1 & 0 \le n \le N-1 \\ 0 & otherwise \end{cases}$. Determine the location and the value of the largest possible sample of $y[n] = x[n] * h[n]$ (linear convolution) without performing the convolution. Find the circular convolution from equations. (Not using the graphical method).

3. If the input $x[n] = \left(\frac{1}{2}\right)^n u[n] + 2^n u[-n-1]$ gives an output of $y[n] = 6\left(\frac{1}{2}\right)^n u[n] - 6\left(\frac{3}{4}\right)^n u[n]$ for an LTI system, then
   a. Draw the pole zero plot for the system function along with ROC.
   b. Come up with the difference equation that this system can be represented.
   c. Is this system stable? Is this system causal?

Section C. Each question carries five marks.

1. Give different canonical or non canonical forms of realizing a digital system. Discuss some of the issues in choosing a structure.

2. Derive the frequency response of an exactly linear phase FIR system whose impulse response is anti-symmetrical with odd number of samples. Using this draw the system response with even number of samples. Using the duality, draw the FIR systems frequency response with N even and odd whose impulse response is symmetrical.

3. Determine DFT for $x[n] = \begin{cases} 1 & 0 \le n \le 7 \\ 0 & otherwise \end{cases}$ using the radix-2 decimation in frequency domain technique.